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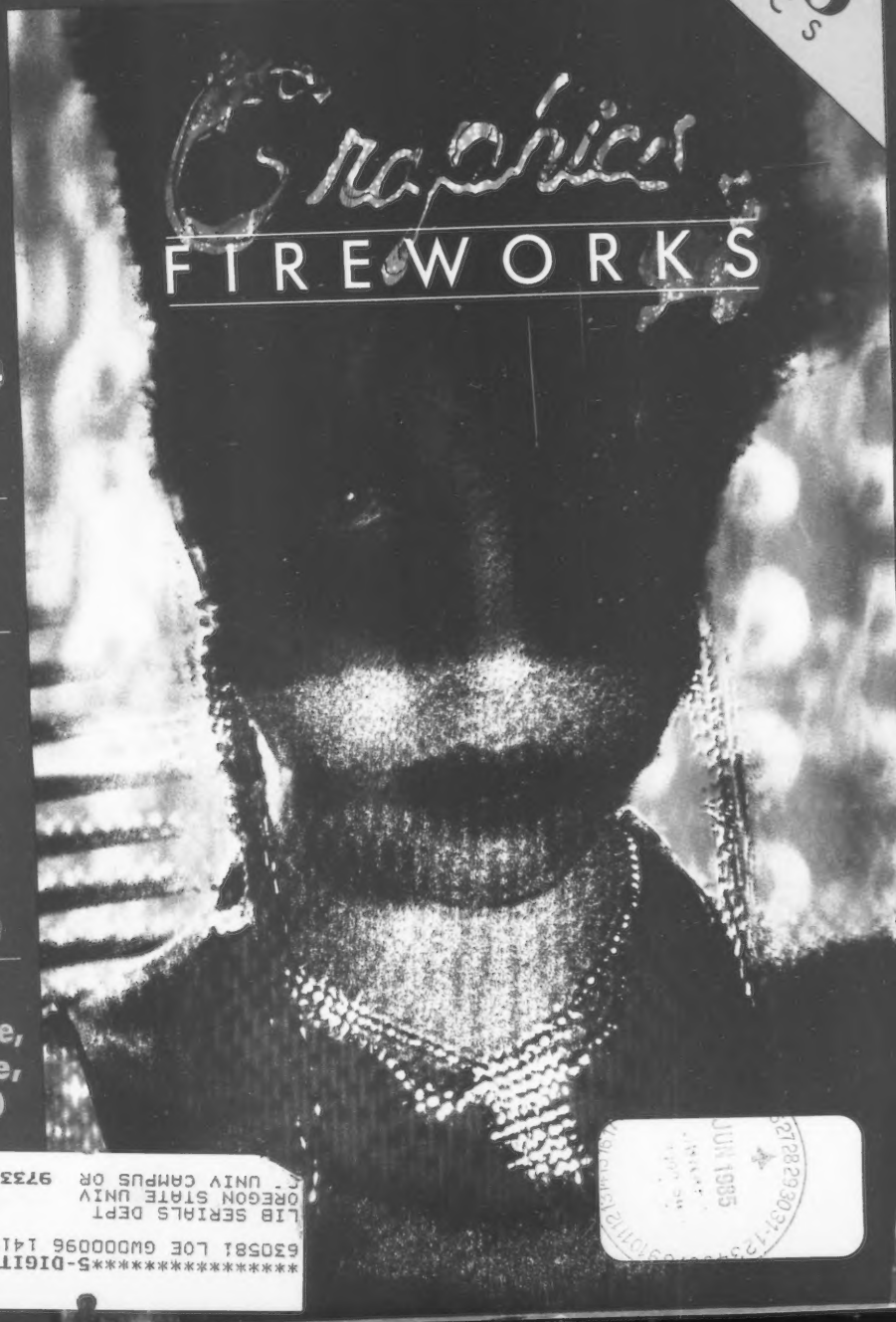

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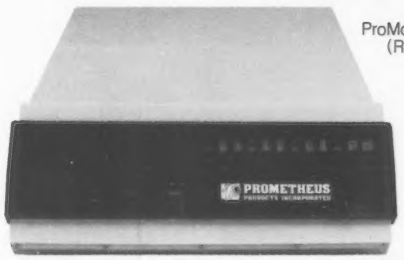

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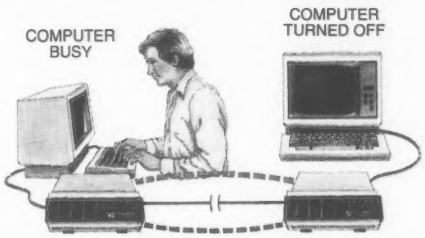

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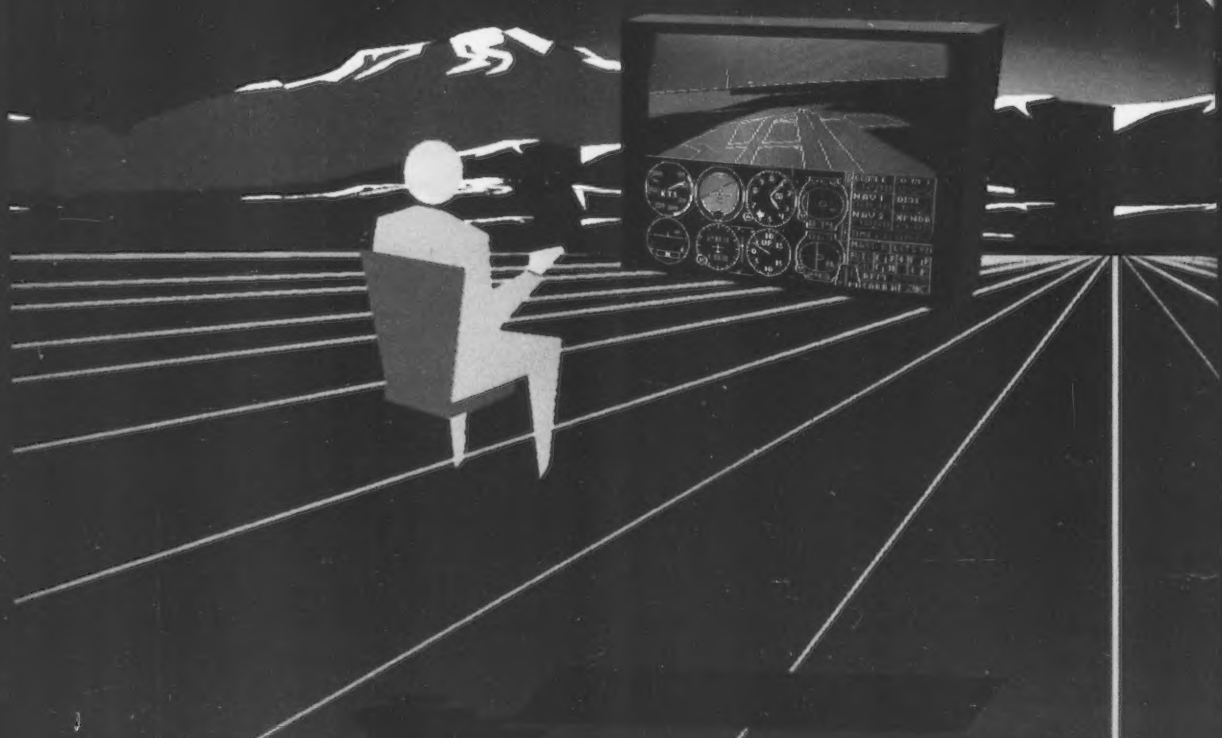

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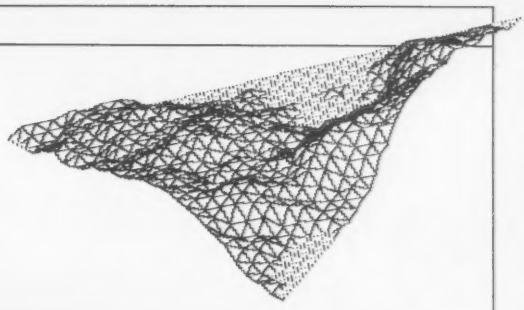

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INDUSTRY INSIDER

David H. Ahl

Kaypro Enters Laptop Derby

The press release gushes that the laptop Kaypro 2000 is Kaypro's lucky number. That may be a little early to predict, but the machine looks very interesting. It has full IBM PC compatibility, 256K of RAM, 80 line x 25 character LCD screen, 720K of disk storage on a single 3 1/2" drive, and a serial port. It also includes a built-in rechargeable battery pack which provides about four hours of operation between charges.

The machine measures 11.5" x 13.1" x 2.6" and weighs 11.5 pounds. Since that would occupy most of an attache case, it comes with a padded nylon carrying case with both handle and shoulder strap. Suggested list price for the whole works including carrying case and battery charger is $1995.

Lotus Active on Many Fronts

In a surprise move, Lotus announced that it has signed a letter of intent to acquire Software Arts and hire its two founders, Dan Bricklin and Bob Frankston. Bricklin and Frankston are the inventors of the original spreadsheet, *VisiCalc*. The terms of the transaction were not disclosed.

The decision to be acquired by Lotus, acknowledged Bricklin, was a result of a sharp reversal of Software Arts' fortunes. Software Arts had licensed *VisiCalc* to Personal Software (later renamed VisiCorp) to market and distribute. However, as the sales of *VisiCalc* declined, the two companies came to legal blows from which neither fully recovered. In the face of mounting losses, VisiCorp was acquired last September by Paladin Software Corp., while Software Arts' revenue plunged to $3 million in 1984 from about $12 million a year earlier. Software Arts currently holds the licenses for *VisiCalc, TK!Solver*, and *Spotlight*.

In its first move into hardware, Lotus signed a letter of intent to acquire Dataspeed, Inc., a vendor of portable stock quote radio receivers. Dataspeed's two products, Quotrek and Modio, receive data transmissions from FM radio sidebands that carry stock quotations.

Lotus also announced new releases of its *Symphony* and *1-2-3* programs which will take advantage of up to 4Mb of RAM. The new releases use the new Lotus/Intel RAM spec which has an eventual capacity of 8Mb. Up to four 2Mb boards can be added to an IBM PC or PC compatible to reach the specified 8Mb capacity. The specification has been made available to more than 30 board makers and software developers.

In addition to utilizing additional memory, *Symphony 1.1* can also interface with the 8087 and 80287 math coprocessors, which should dramatically improve the computational speed of the software. *Symphony 1.1* has a minimum memory requirement of 384K and is priced at $695. The revised *1-2-3*, which will be available next fall, will be priced at $495.

Cellular Array Processing

A cellular array processor (CAP) under development at the ITT Advanced Technology Center has the potential of providing a desktop computer with the processing power of a large mainframe machine and replacing a mainframe with one a hundred times as powerful.

Compared to a conventional processor which performs operations sequentially (multiplication, for example, is a series of additions), a CAP does many operations simultaneously and in parallel. One of the main CAP parts is a VLSI array chip which contains one-bit processors. Each one-bit processor has its own set of 32 general purpose registers and its own memory of from 16K to 64K bits. These processors can be duplicated as many times as will fit on a chip. Currently a chip with 16 processors has been fabricated, but the number is expected to rise as VLSI design and manufacturing techniques continue to improve. The CAP chips themselves can be wired together to form processing arrays of virtually any power and speed required.

Flexibility results from the way the processors are programmed. For example, a 16 x 16 array of one-bit processors could do 32 simultaneous 8-bit additions or a single 256-bit addition.

Along with simplicity, flexibility, and speed, the CAP design boasts high fault tolerance. As the technique is relatively inexpensive, it should result in inexpensive systems with high processing capability and excellent reliability.

Because it can perform many simultaneous operations, the CAP is particularly suited to solving problems that involve large quantities of similar data, such as speech recognition, image processing, robotics, and office automation.

Random Bits

Watch for the introduction this fall of a 10Mb hard disk on a single IBM PC board; the entire assembly is less than 1" thick . . . The **Corporation for Science and Technology** approved a $3.5 million contract with Int'l CMOS Technology and Purdue University for the development of an advanced erasable/programmable non-volatile memory product that incorporates "technology which is expected to dominate the semiconductor industry for the next ten years." . . . The **Honeywell Physical Sciences Center** has announced an optical interconnect consisting of a gallium arsenide laser diode with its associated drive circuit and an optical detector and amplifier on a single chip, coupled to an optical fiber. The interconnect, with transmission rates in the gigabit range, is ideal for short communications links between silicon chips, circuit boards, and processors in a distributed network.

IBM has announced it intends to do battle with Japan in the low-end printer market. It has debuted two units. The $549 dot matrix Proprinter offers three print speeds and near letter quality. A unique paper feed mechanism allows it to handle both single sheets and envelopes while continuous form paper is left in the machine. The Color Jetprinter prints in seven colors on standard bond paper, coated stock, and transparencies. The inks are stored in easy-to-change, "no mess" cartridges.

ITT has announced a repositioning of the ITT Xtra computer. "Repositioning" in this case seems to mean a 41% price reduction from $4395 to $2595 for the 256K Model III with 10Mb hard disk. Similar price reductions were announced on other configurations . . . The 10th West Coast Computer Faire filled Moscone Center with a record-setting crowd of 50,363 attendees . . . First Star Software has announced a licensing agreement with DC Comics for Superman and Wonder Woman. The two heroes will be featured in a series of Super Powers games to be released in September. ■

INPUT/OUTPUT

DR Draw Rated Mediocre

Dear Editor:

Kerry Leichtman's review of *DR Draw* in the February issue is, in my opinion, an example of the challenges faced by reviewers of technical products. What Mr. Leichtman says is true, as far as it goes. The problem is that after using the program for almost nine months, my observation would be that it is *almost* a good (not excellent) product; as it stands, however, I would have to give *DR Draw* a mediocre rating.

For example, the word *slow* is generous. If used on a system lacking an 8087 chip, the speed of *DR Draw* is abysmal. This is because all curved elements in the drawing are regenerated mathematically every time the screen is redrawn. The review states that the program supports 12 fonts, *but* even though there is plenty of space on the disk, and presumably in the directory, only two new fonts can be used at a time. And, even though the program resolution is intrinsically high, none of the high resolution boards for the IBM PC is supported; therefore, the internal high resolution of the program cannot be used on the screen.

Far more serious, in my opinion, is the lack of features which are standard in most graphics programs of this type. For example, there is no possible way to rotate a design; if you want the same rectangle oriented horizontally and vertically, you must draw two separate rectangles. Worse, designs cannot be combined for the purposes of moving and scaling. This means that if you have a labeled box on an organization chart (such as the one used in Digital Research's advertisements for this product), either the box or the text inside (one line at a time) can be moved and scaled, but the box and the enclosed text cannot be manipulated as a single element. This effectively destroys the ability to create complex objects and manipulate them with the program.

Finally, output cannot be scaled as appropriate for the device. There is one and only one size for the actual output on a Hewlett-Packard plotter in vertical orientation; even though the HP 7475 (which is supported by *DR Draw*) will plot on B size sheets, *DR Draw* does not allow this option.

Many similar examples of the failings of *DR Draw* could be noted. It appears to be a product that was built around the GSX Software environment, basically as an interface looking for an application. It is incomplete, not well documented, and poorly supported. What would you have expected from the creaters of CP/M?

John L. Fike, Ph D., P.E.
Communications Enterprises
P.O. Box 795038
Dallas, TX 75379

Where Are They Now?

Dear Editor:

In the November 1983 issue of *Creative Computing*, you evaluated the NEC PC-8800 computer. I really enjoyed your article, and purchased a PC8801A.

I'm interested to know what has happened to this machine since. I'm typing on the *Wordstar 3.0* version now, however, I've sent in my *Wordstar, Multiplan* and CP/M disks to NEC today with a check for $75 for updated versions.

It is not often that someone who reviews a machine goes back to it six months or a year later and gives us readers a status report. How about it?

Bob Scharp
14850 Phelps
Bridgeton, MO 63044

Much as we would like to do updates on computers—like the 24,000-mile extended road tests done by some automotive magazines—rarely will a computer manufacturer lend us a machine for longer than the 30 to 60 days required to do the initial test. Tandy, TI, and the old Atari are exceptions: on occasion they have lent us machines for extended periods.

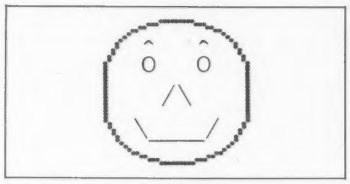
Occasionally, we purchase computers for our own use which we report on from time to time. But probably the best way to keep up to date on a specific computer is through manufacturer and user newsletters and local computer clubs.

—DHA

Juki Graphics

Dear Editor:

In the May 1985 issue of *Creative Computing*, you had a generally favorable Product Review of the Juki 6300 daisywheel printer by Owen Linzmayer. But there *was* one statement that needs correction. He said, "As far as the typical user is concerned, without the custom software required to use the 6300 in this fashion, you can forget about getting graphics on a daisywheel printer." Actually, all that is needed is a full-featured word processor—one that allows you to insert printer control codes into text. It is then quite easy to do graphics with a daisywheel printer, using either the period as shown below or the underline and vertical bar.



This graphics example was entered and printed using the word processor that I wrote. And Mr. Linzmayer neglected to mention that Juki's precise paper handling makes it easy to microjustify by adding tiny spaces between letters. While I used the Juki 6100, the Juki 6300 would presumably act the same in these respects.

I agree with Mr. Linzmayer's overall assessment of Juki printers: Well-built, convenient and reliable.

Delmer D. Hinrichs
2116 S. E. 377th Ave.
Washougal, WA 98671

Tandy 2000: Better Than Ever

Dear Editor:

In the January issue of *Creative Computing* Russ Lockwood reviewed the Tandy 2000. I felt the article was very accurate except for two very important omissions. The first is that Tandy sells the 2000 with 256K. As you said, your machine came with 128K and in explanation, I would guess that it was an older model which can be upgraded to 256K at no charge at the time of purchase. The second is that Tandy has just reduced the price of the 2000/256K to $2499 less monitor.

Again, I thank you for your fine review.

Edwin E. Lewis, Jr.
4216 Race St.
Portsmouth, VA 23707

We checked on this new information and you are absolutely correct. It just goes to show how dynamic the industry is.

—RL ■

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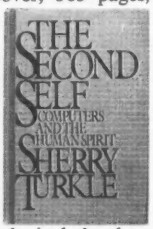
BOOK REVIEWS

Basic, word processing, and lightweight reading

Russ Lockwood

The Second Self: Computers and the Human Spirit by Sherry Turkle. Simon and Schuster. Hardcover, 363 pages, $17.95



MIT Professor Sherry Turkle, with a joint doctorate in sociology and psychology from Harvard University, explores the effects of computers on human social life and psychological development. She examines how different groups of computer users—children, professional programmers, hackers, home enthusiasts—become preoccupied with computers.

Turkle details the achievements, frustrations, and inner passions confronting the subjects of her six-year study. The extensive observations of children working at computers are especially enlightening, and for parents, especially poignant. She uncovers the many roots of computer addiction and explains the intensity of the relationship between man and machine.

Frankly, many readers will consider her discourse nothing more than repetitious drivel laced with liberal doses of ontological mumbo jumbo. That is a shame, for Turkle presents an interesting look at the computer culture, and, more importantly, a look into the motivations of the dedicated computer user.

The Guidebook for Winning Adventures by David and Sandy Small. Baen Enterprises, 8 W. 36th St., New York, NY 10018. Softcover, 339 pages, $9.95

Warning: this book can be hazardous to your adventuring health. Once you read the explicit instructions for solving puzzles, you may lapse into bouts of self-mutilation as you kick yourself for not figuring out the answer sooner.

This book provides all the help you will ever need to solve six of those marvelous Infocom text adventures: *Enchanter, Infidel, Planetfall, Zork I, Zork II,* and *Zork III*. It details each step down to the exact commands; lists treasures, objects, and spells; provides a beginning-to-end summary of play; and gives you a complete set of maps to all six games.

Best of all, the clues are in code. This prevents you from accidentally seeing too much too soon. Of course, you must learn to use this book only as a last resort. Otherwise, you may give in to temptation and rely on the book rather than your own deductive powers for all the answers.

We looked at the clues for *Zork I*: how to enter Hades, how to wind through the maze, how to obtain the bauble. In short, the clues are accurate and helpful.

David and Sandy Small, no strangers to *Creative Computing* readers, deliver an excellent guide to beating selected Infocom adventures. If you are stymied, frustrated, or otherwise baffled by a particular puzzle in any of the six titles listed above, buy this book.

Microcomputer Displays, Graphics, and Animation by Bruce A. Artwick. Prentice-Hall. Softcover, 374 pages, $18.95

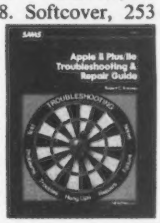
Bruce A. Artwick, the creator of Sublogic *Flight Simulator* and *Flight Simulator II*, consolidates his graphics expertise into one convenient volume. He presents the theories, techniques, and tricks behind animation, simulation graphics, and computer-aided design.

Artwick starts with the basics—coordinate systems, point manipulation, and line generation, and works his way into ellipses, curves, and other geometric elements. He examines algorithms and other mathematical considerations, three-dimensional shapes, scrolling, and a host of specialized functions. He also looks at hardware—from display terminals to joysticks to display controller chips.

Appendices cover foreign video standards and specialized graphics data for the Apple II and IBM PC computers. Numerous charts, diagrams, and drawings illustrate points discussed in the text.

The more you read this book, the more you appreciate the practical uses of Artwick's information. This book is highly recommended for the graphics programmer.

Apple II Plus/IIe Troubleshooting and Repair Guide by Robert C. Brenner. Howard W. Sams, 4300 W. 62nd St., Indianapolis, IN 46268. Softcover, 253 pages, $19.95



In the introduction, Robert C. Brenner tells of waiting eight days and paying $54.23 to have a computer store repair a defective A key on his "first real computer" the Apple II+. He vowed never to be at the mercy of a store again and became a self-taught computer repairman.

The result of his research is a hands-on book that holds a wealth of information about fixing your Apple. Step-by-step instructions teach you how to locate problems and make simple repairs. Experience in computer troubleshooting is not a prerequisite, but you should possess a willingness to tinker with the electronic innards of your computer.

The book describes specific hardware malfunctions and leads you through a flowchart of repair options. Profusely illustrated with photos, drawings, and circuit diagrams, it tells what chip controls which function and shows you how to replace a faulty chip.

Brenner also wrote *Commodore 64 Troubleshooting and Repair Guide* and the *IBM PC Troubleshooting and Repair Guide* ($18.95). Both follow the same format as the Apple II guide and are just as helpful. The introductions, in fact, are identical—complete with defective A key and $54.23 repair bill for his "first real computer." I can only wonder which "real computer" actually came first.

Both books are invaluable guides for the do-it-yourself computer repairman. If you own an Apple II+/IIe, IBM PC, or Commodore 64 and feel comfortable probing the electronic wonders of your machine, by all means pick up one of these books.

Photography by Jeff MacWright.

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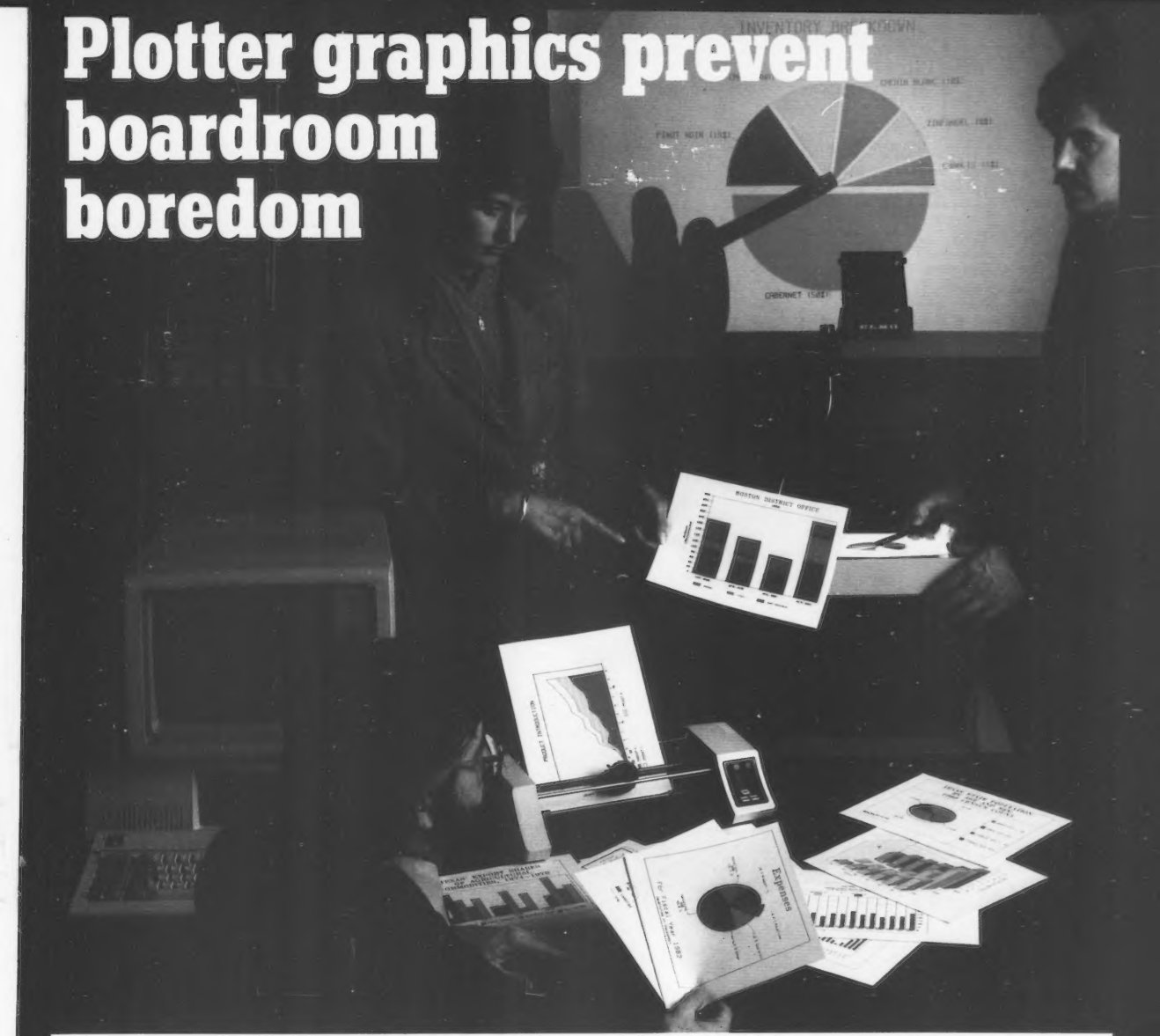

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BOOK BRIEFS

Basic

Basic Business Package for TRS-80 Computers by Bradford R. Russo. Weber Systems, 8437 Mayfield Rd., Cleveland, OH 44026. Softcover, 209 pages, $14.95

This book provides complete listings of inventory, accounts receivable, and order entry programs written in Model 4 Basic for the TRS-80 Model II and 4.

Commodore 64 Basic Programming with Technical Applications by Vincent Kassab. Prentice-Hall. Softcover, 234 pages, $15.95

Do not let the title fool you, this is another book that teaches you how to program in Basic. The "technical applications" consist of various graph programs and a database program.

Basic Business Subroutines for the Apple II and IIe by Alan G. Porter and Martin G. Rezmer. Addison-Wesley. Softcover, 224 pages, $12.95

This helpful book provides subroutine listings in Applesoft Basic for business applications. It includes a screen text editor, help functions, page scrolling, data entry system, menus, report generator, and a personal calendar.

101 Programming Surprises and Tricks by David L. Heiserman. Tab Books, Blue Ridge Summit, PA 17214. Softcover, 196 pages, $11.50

This off-the-wall series provides Basic listings of 101 "fun" programs. Many are useless, but most possess enough value to be considered entertaining. Editions are available for the Apple II, TRS-80, and IBM PC computers.

Basic Fundamentals and Style by James S. Quasney and John Maniotes. Boyd & Fraser Publishing, 286 Congress St., Boston, MA 02210. Softcover, 466 pages, $20.00

Written by two Purdue University professors, this extensive book is designed for a student enrolled in a one-semester college course. It is filled with problems, exercises, and listings. An *Instructor's Manual and Answer Book* is available.

Basic by Bijan Mashaw. Mayfield Publishing, 285 Hamilton Ave., Palo Alto, CA 94301. Softcover, 576 pages, $23.95

This guide to learning Basic, written by a professor at California State University, is also geared for the student. It too is filled with problems, examples, and listings. Likewise, an *Instructor's Manual* is available.

Word Processing

The Illustrated EasyWriter II Book by Russell A. Stultz. Wordware Publishing, 1104 Summit Ave., Plano, TX 75074. Softcover, 259 pages, $16.95

This is, by far, the best "how to learn *EasyWriter II*" book yet. Why anyone would want to learn *EasyWriter II* is not covered.

Using the IBM PC: Multimate by CJ Puotinen. CBS Computer Books. Softcover, 329 pages, $20.45

Multimate is one of the hottest selling word processors around, especially in the corporate arena. This book gets the nod for clarity, organization, and instruction.

Microsoft Word Made Easy by Paul Hoffman. Osborne/McGraw Hill, 2600 Tenth St., Berkeley, CA 94710. Softcover, 246 pages, $14.95

Whether you own a Macintosh, IBM PC, or Tandy 2000, this book presents all you need to know to master *Word*.

WordStar Without Tears by Ruth Ashley, Judi N. Fernandez, and Robert Sansom. John Wiley & Sons. Softcover, 224 pages, $14.95

Here is one book that helps eliminate the myth that *WordStar* is too difficult to learn.

The Apple Writer II Handbook by Kate Lee Johnson. Van Nostrand Reinhold. Softcover, 198 pages, $19.50

This book helps you wring the most out of *Apple Writer II* and your Apple II+, IIe, or IIc.

The Bank Street Writer Book by Don Beil. Reston Publishing, Reston, VA 22090. Softcover, 256 pages, $19.95

This is the book to buy if you use the popular *Bank Street Writer* word processor.

Lightweight Reading

My Life as a Robot by Ed Fish. Congdon & Weed, 298 Fifth Ave., New York, NY 10001. Softcover, 154 pages, $12.95

This collection of anecdotes—some funny, some trite, and some touching—tells the story of a master showman who operated a robot at trade shows.

They All Laughed When I Sat Down at the Computer by Erik Sandberg-Diment. Simon & Schuster, 1230 Avenue of the Americas, New York, NY 10020. Softcover, 277 pages, $16.95

Efforts to explain computing to rank novices result in an incredibly boring mixture of the author's memories and well-worn history. While reading the book, I did not laugh.

The Sachertorte Algorithm and Other Antidotes to Computer Anxiety by John Shore. Viking, 40 W. 23rd St., New York, NY 10010. Hardcover, 238 pages, $16.95

Another cutesy book attempts to explain computers to the uninitiated.

Sorry About the Explosion: The Humorous Guide to Computers by David D. Busch. Prentice-Hall. Softcover, 152 pages, $7.95

Biting satire traces the development and marketing of a fictitious computer by an equally fictitious manufacturer. This parody of the computer industry provides low blows, backstabbings, and other well-deserved cheap shots. Some belly laughs, a few chuckles, and many knowing smirks make this tribute to the absurd enjoyable reading.

Do You Really Need a Home Computer? by Derek Rowntree. Charles Scribner's Sons. Softcover, 144 pages, $6.95

The author shows a remarkably tenuous grasp of home computers and computing. This is the book for computer Luddites.

Sing a Song of Software by Leonard Soltzberg. Wm. Kaufman Inc., 95 1st St., Los Altos, CA 94022. Hardbound, 88 pages, $9.95

Peter Payack brings alive
technology in verse.
But singing Soltzberg's software
song,
will leave you bored or worse.

The Joy of Computer Chess by David Levy. Prentice-Hall. Softcover, 128 pages, $7.95 paper; $14.95 cloth

International Chess Master Levy describes the principles of chess programming, including examples and strategies. A real joy for the chess enthusiast. ■

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TELETALK

Flying the electronic skies

Corey Sandler

There are, I'm told, some people who buy their airline tickets to Kuala Lumpur on a whim, throw a few sets of underwear and a package of Dr. Scholl's in a backpack, and mosey on down to the airport.

That is not, let me assure you, the manner in which my family heads hither and thon. First of all, the actual trip is often anticlimax—most of the effort and the enjoyment comes in the planning and the list-making. For weeks before departure, we will clear the local bookstore of all "popular" travel books before descending upon the library for the really serious research. For us, a minor jaunt from New York to Washington resembles Dr. Livingstone's party, with teams of bearers carrying suitcases stuffed with guidebooks and newspaper clippings.

And so, it was with quite a bit of interest that I discovered that the world of electronic telecommunication has developed and recently enhanced a diverse set of offerings aimed at the serious traveler. These services, I found, range from travel books with descriptions and suggestions for exploration to hotel listings to passport and visa information to State Department advisories to a new service that allows the traveler actually to book airline tickets without having to set foot in a travel bureau.

In this column, we'll concentrate on the offerings of the CompuServe public telecommunications network. Similar services, though, are also available from The Source, Dow Jones, and a number of other public networks. And some of the individual services may be available on-line from their original sources.

Basic Research

If you are open to any suggestion as to where and how to go, or if you are interested in conferencing on-line with other avid travelers, you might want to start at the Travel SIG (Special Interest Group). The system operator for CompuServe's special section calls himself Captain Wookie, which if truly his name certainly qualifies him as an expert guide to the galaxy.

Looking for a warm port on a cold

day, I found inside reports on Cancun, Isla Mujeres, and Negril Beach among the listings of the Travel SIG. There is a directory of members of the SIG with their special interests and areas of expertise, and there is a public bulletin board upon which you can electronically tack a message of inquiry. There is no extra cost for use of the SIG beyond applicable CompuServe connect time charges.

If you have chosen a place to visit, you next might want to look into a place to stay. I found two interesting electronic aids. First I looked into something called the A-Z Hotel/Travel Guide. This service claims national and international travel news headlines as well as comprehensive listings of more than 20,000 hotel properties worldwide. Data includes address and location, phone numbers, rates, facilities, and special services. You can search for a hotel by specifying a city, the hotel name or chain, or the specific facility or service you are looking for. Apparently, though, 20,000 listings are not enough to cover the desert island we were researching, Curacao in the Netherlands Antilles. I could find no entry there, and just know there has to be a place to sleep there.

One problem with A-Z is that it is very specific in asking for a city to go with the country you have specified; if you are vague about location, the guide may be only vaguely helpful.

Next I signed on to the WWX Vacation and Leisure Property Exchange. This is a specialized classified ad database with homes, condominiums, apartments, timesharing units, and even yachts and recreational vehicles for rent and exchange. Here's a sample listing, and if you can't find me at home some January evening you might try me there:

> "British West Indies. 2 Bdrm house, Pine Cay on Turks & Caicos Island. Sea views from every window. White sand beach, scuba diving, snorkeling, deep-sea fishing, sailing. Private club with gourmet dining. Private planes welcome on 4000-foot airstrip. $1050 per week."

Interested travelers are advised to write directly to advertisers. Participants offering homes pay a display charge to WWX; CompuServe users pay no added fee for browsing.

Getting Your Shots

All right, then, what about passports and immunizations? Well, Pan American Airlines has placed on line an electronic edition of the renowned Pan Am Immigration Guide used by travel agents and international corporations around the world. There is within its bounds a complete listing of countries from Abu Dhabi to Zambia. There is a compendium of immigration requirements and a listing of embassies and consulates in the U.S. I discovered, for example, that Curacao and its sister Antilles islands maintain quite a few representatives in our country, including for some reason a vice consulate in Orange City, IA.

Also in the Pan Am guide is a section with advisories of disease infected areas around the world. You get your choice of searching for countries with the plague (a distinction borne only by Vietnam) to cholera (20 countries from Burundi to poor Vietnam again, to smallpox, typhus, and yellow fever).

And if that isn't cautionary enough for you, there is the U.S. Department of

State Travel Advisory Service. This service on CompuServe carries advisories and warnings of such things as outbreaks of warfare, political unrest, currency and import regulations, and really important things like hotel room shortages. (I didn't see bulletins on outbreaks of warm beer, surly waiters, or dishonest cabbies.)

There didn't seem to be anything untoward happening on Curacao, so I picked at random the listing for Lesotho in Africa:

> "The Department of State advises American citizens planning to travel to Lesotho that roadblocks and roving patrols conducted by military and police units are becoming increasingly frequent in Maseru and Lesotho. American citizens . . . are advised that serious incidents have occurred when persons traveling in vehicles have failed to halt at the directions of such units. Visitors are urged to exercise exceptional caution at night and to consult the embassy for specific guidelines on personal security."

Aside from that, before you set out on the road to Maseru from Lesotho, you'd probably do well to get yourself a good set of maps. A service on CompuServe called Travelvision sells maps and routing services just like the gasoline companies used to give away. Travelvision also offers atlases, globes, and auto tape tours for many parts of the world.

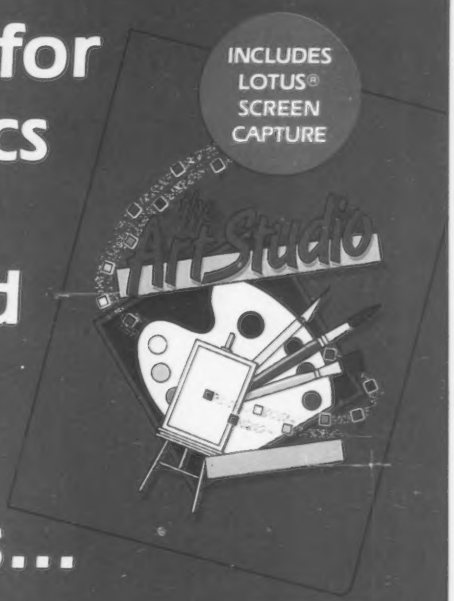
Buying the Friendly Skies

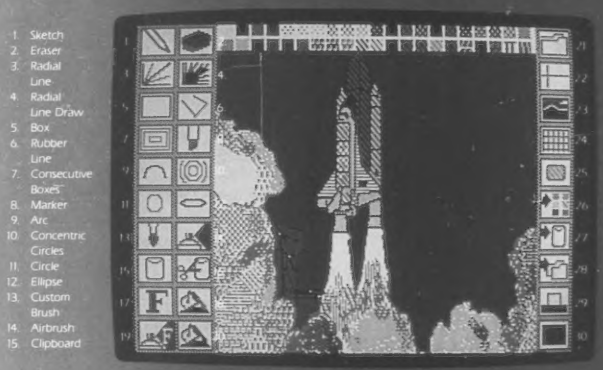
And by now you may be ready to buy that airline ticket. Here is where an electronic database can really show its stuff. There are two major services available here—one a long-established, capable compendium of data, and the other a recent breakthrough in almost-direct access for the traveler.

The veteran of the pair is the electronic version of the Official Airline Guide. The OAG in its original form is the phone book-like guide you may have seen on your travel agent's desk. It lists every domestic location with scheduled air service, including information on fares, type of aircraft, airport location, inter-flight connection times, and other essentials for the well-prepared traveler.

The printed version of the OAG, available in domestic and international form, is one of the most complex and changeable databases in common use by non-computer users. And so, when a few years ago the publishers of the OAG put

We did for Graphics what Borland did for Desk Utilities...





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most of that information on line, it was an important breakthrough for professional travel services. And more recently, OAG began offering access to its database directly to the public and indirectly through networks like CompuServe.

When you "Go OAG" to gain access to the system through CompuServe, you are greeted with a stark but workable system that relies on single-letter codes. You choose a starting point and a date, and select an approximate time for departure. The screen then fills with the listing for that combination. You can expand the listing to obtain a chart of applicable fares, and you can quickly reverse the direction for the return flight. Included in the OAG information is airport, departure and arrival time, flight number, type of equipment, number of stops, and meal information. Users are billed at $32 per hour over and above standard CompuServe connect rates for prime time usage; $20 per hour for off-peak usage.

TWA has gone one step further—well, perhaps two-thirds of a step further. The airline's PARS (Programmed Airline Reservations System) is the third largest such operation in the airline industry. (Only American Airlines' Sabre and United's Apollo are larger.) The company set up PARS in 1971 for its own reservations operations, and opened its computers up to the travel agencies in 1976 after the U.S. Department of Justice knocked down proposals by the major airlines for an industry-wide system.

By the beginning of this year, TWA had enrolled 3650 travel agencies in the United States. PARS is not limited to the listings of TWA, instead including the route and fare information for every scheduled airline in the country and most overseas lines. Usage charges are $20 per hour over CompuServe connect rates for prime time and $15 per hour for non-prime usage.

Now, the difference between PARS (and its airline industry competitors) and the OAG is like the difference between a baseball records book and the seventh game of the World Series. With OAG you can find out all of the possible destinations, carriers, and fares. With PARS, you can also find out whether seats are available on a particular flight, and whether any of the ridiculously complex discount air fares are applicable. And then, using PARS, you can go ahead and book your flight.

And so, it was with a bit of excitement that many hardened travelers greeted the news that TWA had decided to open up PARS to the public, through CompuServe. TWA calls its service Travelshopper. The information is similar to that available to the travel agent, with a claim of 100,000 "city pairs" (a "to" and a "from") and about three million(!) fare combinations. Users can check on available seats and fares and then, according to TWA, "book" their seats.

```
26FEB-TUE          LEAVE: CHICAGO
                   ARRIVE: LAGUARDIA ARPT

 #  FLIGHT   LEAVE      ARRIVE     EQP STOP
 1  AA 234   ORD-1100A LGA- 148P  72S   0
 2  UA 908   ORD-1100A LGA- 148P  72S   0
 3  ML 866   MDW-1100A LGA- 200P  M80   0
 4  TW 322   ORD-1045A LGA- 133P  72S   0
 5  UA 390   ORD-1128A LGA- 303P  727   1

 KEY RETURN TO SEE MORE
 KEY * FOR PREVIOUS SCREEN
 KEY LINE # FOR BOOKING DETAILS
 C- CHANGE DATE      R- RETURN FLIGHTS
```

The user indicates date, time, and place of departure, and destination. Travelshopper lists the available flights for almost every airline in the world.

Therein lies a rub. After you've gone and selected a flight all by yourself, checked availability, and made your purchase, TWA wants you to let your friendly neighborhood travel agent print out your ticket and hand it to you. For this minimal involvement, the travel agent receives his or her full commission from the airline; you get "Have a nice day."

Also excluded from listings in Travelshopper are vacation packages that include hotels, cars, and the like, although TWA executives hinted that such information may eventually be added. United Airlines, PeoplExpress, Singapore Airlines, Southwest Airlines, and possibly a few other smaller companies have chosen not to allow their tickets to be "sold" through Travelshopper. You can check on their flights, but the sale must be through an agent or directly with the airline.

I selected a flight at random—New York or Newark to Kansas City on June 10 for a midday jaunt to pick up some ribs for dinner. Travelshopper showed a screen very much like that offered by OAG, and I narrowed my choice down to TWA's flight 227, which connects at St. Louis. (I chose from flights on USAir, World, Eastern, Frontier, and Midway Metrolink.) I expanded the listing for the flight and found that seats were readily

available in all sections on both legs of the flight—in first class, coach, and special fare areas. I also learned that lunch is served on the flight from Newark to St. Louis, and that on the flight from there to Kansas City, meal service "varies," which is an unusually honest admission by an airline, although I suspect they intended something other than a comment on quality.

The reason for TWA's bias in favor of its travel agents is obvious—about 70% of the airline's revenues come from tickets booked by agencies, and that is not a constituency TWA seeks to anger. There was provision in the original Travelshopper plan to allow clients to charge their tickets and have them mailed directly to their homes. At the press conference announcing the Travelshopper service, a number of reporters pressed airline spokesmen for justification of the emphasis on dealing with the travel agency. They pressed so hard that a TWA vice president made an on-the-spot policy change, but not in the direction most of us were expecting. "I have just decided that Travelshopper will no longer send tickets direct to users at all," said Edward J. Gehrein.

Don't you telecommunications users wish he had acted differently? His address, by the way, is Trans World Airlines, 605 Third Ave., New York, NY 10158.

And so, we are now at a two-thirds-of-the-way juncture. Using CompuServe or another of the public networks, we can do all of the research and planning for our vacation. We can pick the spot, check out the security, acquaint ourselves with the local plagues, find the borderlines for civil wars, and then pick our airline flight. Then, we contribute our services to the travel agent who prints out the ticket based on our research.

If it sounds as if I have my reservations about the worthiness of investing all of that time and then ending up with a travel agent anyway, well, yes I do. But then again, it could be worse. The last time we completely entrusted a trip to a travel agent we swore, when we finally limped home, never to leave the research to someone who would swear on a stack of OAGs that Cape Breton is in France and Brittany in England.

Oh well. We're off on our annual Caribbean jaunt on Sunday. Let's see: we've packed the swim suits, the suntan lotion, the baby, three cartons of guidebooks, and a portable computer with a modem. Skycap! ■

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TRY THIS!

Toss and test: Improved random searches with outcome testing/**Edward H. Carlson**

What do a stock speculator, a hungry bacterium, a code breaker, and a typing monkey have in common? Answer: All of them use "toss and test" to get ahead in the world. This article demonstrates toss and test with two programs.

Ok. I confess that I made up the "toss and test" name myself. "Toss" as in tossing a coin, "test" as in looking to see whether it is heads or tails. The toss and test process is a repeated set of random events sandwiched with tests of the results. It sounds commonplace enough, but it has surprising consequences.

Drowning in a Sea of Facts

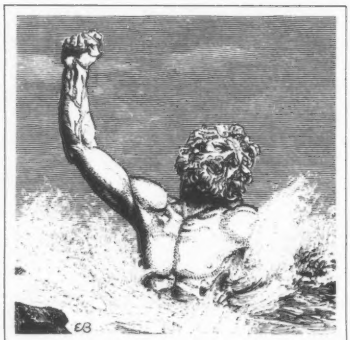
Toss and test is a way of grabbing at a goal while drowning in a sea of facts. Your grandpa's "By guess and by gosh" and grandma's "If at first you don't succeed, try, try again" are beginning points for the method.

In biology, it is called "mutation followed by natural selection." It also guides bacteria in their search for the sweet spots in their environments. The disgusted stock speculator, picking stocks by tossing darts at the financial page of his newspaper, may be surprised by his success when he sandwiches dart tosses with careful market timing. It is valuable anywhere else that decisions must be made with confusing or insufficient data as input.

The Sandwich and the Amplifier

The toss and test process is a set of random trials sandwiched between tests or evaluations of the results. Anyone who builds complex systems uses an analogous method: "build a part, test, build, test, assemble into a bigger unit, test ..." We can call this brother of toss and test the "build and test" method. Both are important for computer users.

Before trying out toss and test simulations on our computer, let's compare the computer as simulator with some of its other uses. We were promised that the computer would be our mind amplifier, doing all sorts of important thinking for us. But nowadays the computer—as a mental servant—helps us primarily with such menial tasks as mailing list preparation, sorting, word processing, and so forth.



Toss and test is a way of grabbing at a goal while drowning in a sea of facts.

What went wrong? The computer is a mind amplifier true enough, but remember that an amplifier must start with music on a tape before it can thunder a tune through the speakers. Likewise you must have a kit of concepts in your mind before the mind amplifier can do great works for you. Toss and test is just one of a set of integrated concepts that I explain in my recent book *The Thinking Tree*.

In this article we explore the toss and test idea, letting the computer teach you how it works. Toss and test is fun, and it holds surprises in both of the cases we examine.

A Barrel of Monkeys

Sit a monkey down at a typewriter and let it poke the keys at random. People have claimed that eventually it will type every sentence that has ever been written in English. The big surprise is how long "eventually" can be. Try the sentence:

OFF WITH HER HEAD

which the queen of hearts screeched at Alice and just about everyone else in *Alice's Adventures in Wonderland*. It has 17 characters counting the spaces. Start the monkey typing 17 character sentences, letting him pick the characters at random from among 27 characters on the keyboard—the 26 letters and a space.

Here goes. The monkey is typing the first sentence. There is one chance in 27 that the first character will be an O. There is another chance in 27 that the second letter will be an F. So there is one chance in 27 times 27 (equals 729) that the first two letters will be correct. Not such a good start on getting all 17 letters right.

But it gets worse very fast. Continuing the multiplications, we find the chance of getting all 17 characters right is 1 over 27 to the 17th power, or about 1 chance in 2 E+24 (using the scientific notation that our computers employ for very large numbers).

Well, let the monkey type fast, day and night for as long as it takes. Assuming 10 characters per second (a very fast typist) and knowing there are about 3 E+7 seconds in a year (60 x 60 x 24 x 365) we must give the monkey a lot of time. So let's suppose the monkey started his work 10 billion years ago (when our galaxy was first formed). In that time the monkey can try 1.8 E+17 sentences (3 E+17 seconds times 10 characters/second, then divided by 17 characters in a sentence) but is very unlikely to type the queen's favorite sentence.

He needs help! If we set 12 million more monkeys to typing, with a little luck they may produce OFF WITH HER HEAD once in 10 billion years.

So our first surprise is that random poking, which did not look like a very good method to start with, is really much, much worse than we feared.

Hire a Proofreader

The second surprise will be that toss and test, while still half random, is quite practical.

Twelve million monkey typists are more than our budget can spring for. Let's cut our workforce back: hiring just one monkey and also one proofreader,

saving vast sums of money. The proofreader stands behind the monkey and every time the monkey types a letter, the proofreader checks to see if it is correct (that is, if it matches the corresponding letter in OFF WITH HER HEAD). If the letter is wrong, the helper erases it and back spaces the typewriter. This is the toss (random letter) and test (erase if wrong) procedure.

Before running the Toss and Test program (Listing 1), make a guess how long it will take to type OFF WITH HER HEAD by toss and test. The program first tries five sentences by the random all-17-letters-at-once-before-testing method, just to give an idea of what the random sentences look like. They are gibberish, of course. Then the program shows the toss and test method. No trouble at all in deciding which is better. (Toss and Test was written in Microsoft Basic on an IBM PC, but should run on other computers with few or no changes required.)

The Hungry Bug

Now I know you are a practical person, and talk of monkeys does not put bread on the table. I am half practical and will now demonstrate a model of a recent scientific discovery. Here is the experiment.

Take a shallow dish and pour a weak broth containing bacteria into it. When the solution settles down, put a lump of sugar in the dish. The sugar begins to dissolve, providing a high sugar concentration near the lump and a lower concentration farther away.

After a while you will observe that most of the bacteria have congregated near the sugar lump. Sensible, you say. Sure. But bacteria are the world's simplest living organisms, just one cell and, of course, no brain. How do they figure out which direction to swim to get to the goodies? (Of course, the bacteria do not actually need to reach the sugar to eat; they absorb the nourishment in the sugar water through their cell walls.)

Let's watch a single bug and see what happens. The first observation is that the bug swims in a zig-zag path. Each short straight zig is followed by a random "twiddle" to a new heading before the bug sets off on the next zag. The new heading is not completely random however. It is preferentially in a direction similar to the zig it just finished—that is, within about 45 degrees of the old heading. This kind of motion is called a "random walk," and there is no way to predict where it will end. The bacterium has as much chance of swimming toward the sugar lump as away from it. Indeed, as we watch, the bug seems to be getting nowhere fast.

But wait. In all his wandering, he seems to be slowly getting closer to the sugar lump. Observe! Not all the zigs and zags are the same length. If the straight path he finished took him close to the sugar (so he tastes more sugar in the water at the end of the run than at the beginning), the next straight line run, while random in direction, is longer. If he tastes less sugar after the zig, the next zag is short again. This is the toss (twiddle to a random direction) and test (taste and decide on a long or short next zag) method again.

Well, I see you are underwhelmed. Such an adjustment in path length would

Listing 1.

```
1 REM ------------------------- TOSS AND TEST ------------------------------
2 REM file name:TOSS AND.BAS       disk name:CC                E. H. Carlson
100 REM ------------------------- MAIN LOOP ----------------------------------
110 GOSUB 200                           :REM print target sentence
120 GOSUB 700                           :REM random text, complete sentence
130 GOSUB 800                           :REM toss and test
199 END
200 REM --------------------- PRINT TARGET SENTENCE ---------------------------
210 T$="OFF WITH HER HEAD"              :REM target sentence
211 L=LEN(T$)                           :REM length of target sentence
212 CLS:LOCATE 3,1                      :REM clear screen
215 PRINT" TOSS AND TEST DEMONSTRATION"
220 LOCATE 5,1:PRINT " target sentence  ";T$;
230 LOCATE 10,1:PRINT" press any key to continue"
232 R=R+1:Y$=INKEY$:IF Y$="" THEN 232   :REM get random seed
234 LOCATE 10,1:PRINT"                  "
299 RETURN
700 REM ------------------------- RANDOM ONLY --------------------------------
704 RANDOMIZE R                         :REM seed the random no. generator
705 FOR I=1 TO 5                        :REM make 5 tries to match the target
706 LOCATE 7,1:PRINT" random typing     ";
719 FOR K=1 TO L                        :REM target is L characters long
720 X=INT(RND(9)*27)+64                 :REM pick random number for letter
740 IF X=64 THEN X=32                   :REM space character
750 PRINT CHR$(X);:NEXT K               :REM convert number to character
755 FOR T=1 TO 1000:NEXT T              :REM pause
760 NEXT I:PRINT:RETURN                 :REM return after 5 tries
800 REM ------------------- RANDOM PLUS SELECTION ---------------------------
806 LOCATE 9,1:PRINT" toss and test   ";
816 K=1                                 :REM try for first letter of target
820 X=INT(RND(9)*27)+64                 :REM get random number for character
840 IF X=64 THEN X=32                   :REM space character
850 L$=CHR$(X)                          :REM convert number to character
852 LOCATE 9,K+18:PRINT L$;             :REM print on screen
860 IF L$<>MID$(T$,K,1) THEN 820        :REM test if choice matches target
865 K=K+1                               :REM found letter, go to next
870 IF K<>L+1 THEN 820                  :REM repeat if string is not done
899 PRINT:PRINT:RETURN
900 REM ------------------------- DESCRIPTION --------------------------------
905 REM
910 REM                    TOSS AND TEST DEMONSTRATION
915 REM  This program illustrates an important process which I call "TOSS AND
920 REM  TEST."  The process has a large number of small steps: choice steps
925 REM  sandwiched between selection steps.  In this program, a letter is
930 REM  obtained by a random toss.  Then it is tested against a target and
935 REM  discarded if it doesn't match.  The process is repeated until the
940 REM  target is reproduced.  By contrast, 12 million monkeys typing at
945 REM  random for 10 billion years would probably produce the target
950 REM  sentence just once.
```

Listing 2.

```
1 GOTO 2000: ================== THE TWIDDLING BUG ============================
2 REM file name:BUG               disk name:CC                E. H. Carlson
100 REM ------------------------- MAIN LOOP ----------------------------------
104 X0=X:Y0=Y                           :REM store current position
105 GOSUB 300                           :REM go twiddle
108 ON D GOTO 111,112,113,114,115,116,117,118
111 X=X0+S                    :GOTO 120 :REM try move to   right
112 X=X0+S : Y=Y0+S           :GOTO 120 :REM          down right
113 :        Y=Y0+S           :GOTO 120 :REM          down
114 X=X0-S : Y=Y0+S           :GOTO 120 :REM          down left
115 X=X0-S                    :GOTO 120 :REM               left
116 X=X0-S : Y=Y0-S           :GOTO 120 :REM          up   left
117 :        Y=Y0-S           :GOTO 120 :REM          up
118 X=X0+S : Y=Y0-S           :GOTO 120 :REM          up   right
120 IF X< 2 THEN                    105 :REM is bug against the wall?
121 IF X>38 THEN                    105
122 IF Y< 2 THEN                    105
124 IF Y>23 THEN                    105
130 GOSUB 400                           :REM move bug
135 Y$=INKEY$:IF Y$="q" OR Y$="Q" THEN WIDTH 80:END:END OF PROGRAM RUN
140 GOSUB 200                           :REM taste in this new position
```

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TRY THIS!

seem to be of little help to a bug that is determined to zig-zag crazily around. Can it really be the secret of success in the bug world?

Run the Bug program (Listing 2) to see the answer. The bug is in a rectangular tank which has its right side wall coated with sugar. Score is kept on how long the bug spends on the left side and how long on the right. (The program runs as written on an IBM PC, but I took care to use standard commands as far as possible, and you can probably adapt it to other computers with only a little rewriting.)

That takes care of the bug and the monkeys. I leave the stock speculator, the code breaker, and many other applications of toss and test to your own modeling efforts. ■

```
145 GOSUB 500                          :REM update score
150 GOTO 104                           :REM go to next zig
200 REM ------------------------------ TASTE -------------------------------
235 S=1:IF X>XO THEN S=S+S             :REM x is larger near the sugar
299 RETURN
300 REM ---------------------------- TWIDDLE -------------------------------
310 IF RND(9)<.5 THEN 330              :REM half the time, go clockwise
315 D=D-1:IF D<1 THEN D=8              :REM else go cc, check range of d
320 GOTO 390                           :REM return from subroutine
330 D=D+1:IF D>8 THEN D=1              :REM go clockwise, check range of D
390 REM FOR T=1 TO 900:NEXT T          :REM used during debugging program
395 REM LOCATE 5,5:PRINT X;Y           :REM used during debugging program
399 RETURN
400 REM ------------------------------ MOVE --------------------------------
410 LOCATE YO,XO,O:PRINT " "           :REM erase old bug
415 LOCATE Y ,X ,O:PRINT "*"           :REM plot new bug
499 RETURN
500 REM ------------------------- KEEP SCORE -------------------------------
510 IF X<20 THEN S1=S1+1:LOCATE 1, 3:PRINT S1
520 IF X>20 THEN S2=S2+1:LOCATE 1,33:PRINT S2
599 RETURN
1000 REM ======================== DESCRIPTION ==============================
1005 REM
1010 DATA -            THE TWIDDLING BACTERIUM DEMONSTRATION            -
1011 DATA " "
1015 DATA The right wall of the tank is coated with sugar.  The bug wants to
1017 DATA stay near it.  He swims ahead and then tastes for sugar.  (Sugar
1019 DATA increases as X increases.)  If sugar concentration is larger than
1021 DATA before he will take a run (length S) that is twice as long as
1023 DATA otherwise.  Then he turns randomly right or left by 45 degrees
1025 DATA (twiddles) and repeats the whole thing.  Score is kept as to how
1027 DATA long he spends near and far from the sugar.
1099 REM
1100 REM ---------------------- global variables ---------------------------
1110 REM X      x coordinate of bug, horizontal axis, zero at left
1112 REM Y      y coordinate of bug, vertical   axis, zero at top
1114 REM XO, YO old position of bug
1116 REM D      heading of bug: 1 is facing right, 2 down right, etc.
1118 REM Y$     user input of character from keyboard
1120 REM S      length of the next zig
1200 REM ----------------------- local  variables ---------------------------
1220 REM T      variable for a delay loop
1222 REM S1, S2 scores for time spent on the left, and on the right
1224 REM SE     seed for setting random number generator
2000 REM ======================== INITIALIZATION ===========================
2001 REM
2010 GOSUB 2100                        :REM declare variables
2050 GOSUB 2700                        :REM give explanation
2070 GOSUB 2500                        :REM draw initial screen
2099 GOTO 100
2100 REM --------------------- variables and arrays -------------------------
2110 X= 3:Y=12                         :REM initial position of bug
2199 RETURN
2300 REM ---------------------- user initial input ---------------------------
2314 PRINT:PRINT TAB(26);"PRESS ANY KEY";
2315 SE=SE+1:IF INKEY$="" THEN 2315
2320 RANDOMIZE SE
2399 RETURN
2500 REM ------------------------ initial screen -----------------------------
2510 CLS:WIDTH 40                      :REM clear screen, width 40 char.
2511 LOCATE 1,1,0                      :REM cursor in corner, invisible
2512 FOR I=1 TO 24:PRINT "=" TAB(39);"S": NEXT I :REM draw sides of tank
2513 LOCATE 1,1
2514 FOR I=1 TO 39:PRINT "=";: NEXT I          :REM draw top
2516 LOCATE 24,1
2518 FOR I=1 TO 39:PRINT "=";: NEXT I          :REM draw bottom
2530 LOCATE 24,12,0:PRINT"PRESS Q TO END";
2599 RETURN
2700 REM ------------------------ explanation --------------------------------
2710 CLS:PRINT:PRINT:PRINT             :REM clear screen
2715 FOR I=1 TO 9                      :REM write 8 lines of explanation
2720 READ Y$:PRINT TAB(4);Y$:NEXT I
2795 GOSUB 2300:RETURN                 :REM pause.  also seeds RANDOMIZE
8000 REM Written in BASICA and run on an IBM PC with 80 col. green screen
8002 REM For some computers, use GET for INKEY$; HTAB, VTAB for LOCATE
8004 REM These are not exact replacement, see your reference manual.
```

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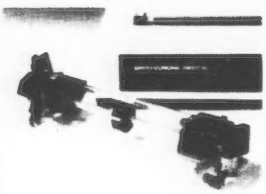

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Printing Speed: 80 CPS

PAPER

Type: Plain
Forms Type: Fanfold, Cut Sheet
Max Paper Width: 11"
Feeding Method: Friction Feed Std.; Tractor Feed Included

RIBBON

Type: Cassette — Fabric inked ribbon
Life: 1 million characters

CHARACTER MODE

Character Font: 9 x 8 Standard, 10 x 8 Elongated, No. 8 pin to be used for underline
Character Set: 96 ASCII, 11 x 7 International Char.
Pin Graph Mode: The incoming bit pattern corresponds to the 8 pins in the print head
Resolution: Horizontal: 60, 72 dots/inch, Vertical: 72 dots/inch

PARALLEL INTERFACES

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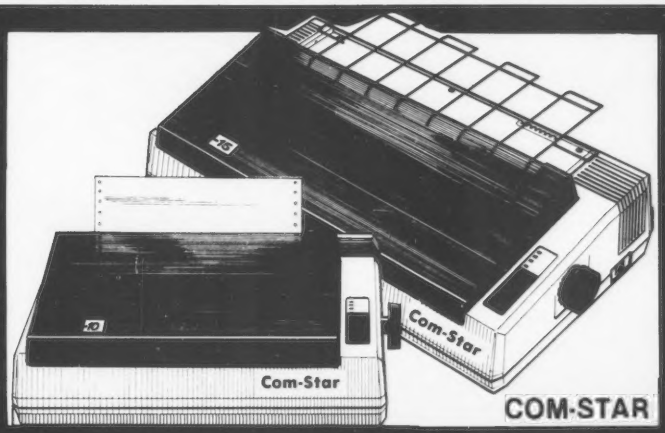

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Kaypro 286i

The first PC AT compatible/**Russ Lockwood**

When IBM introduced the PC back in August of 1981, the company whipped the personal computer industry into a frenzy. Demand, and hence sales, spread like fallout after a nuclear explosion as the market went 8088 and MS-DOS mad. PC clones, followed closely by third-party peripherals, burst on the market with equal fury. Even though 90% of IBM's revenue still came from mainframe and minicomputer sales, the PC held the spotlight.

Three years later, after the ho-hum XT and ill-fated PCjr, IBM introduced the powerful AT (a full review appears in the December 1984 issue). As the first sales figures trickle in, it appears that demand for the AT is soaring. Hard disk failures aside, the AT looks like another big winner for IBM.

Which brings us to the current case of market deja vu. Industry observers expect a dozen AT clones to appear before 1985 closes. So far, four companies have announced them: Kaypro, Texas Instruments, Compaq, and Tiger. Ironically, Kaypro, one of the last to introduce a PC compatible, is the first to deliver an AT compatible—the 286i.

Photography by Jeff MacWright.

Hardware Profile

Name: Kaypro 286i **Type:** Desktop computer **CPU:** 16-bit 80286, 6 MHz
RAM: 512K (addresses up to 15Mb) **Keyboard:** Detachable, 84 keys, slant adjustable
Display: 80 x 25 characters; 320 x 200 pixels (four colors) **Disk Drives:** Two 1.2Mb, 5.25" floppy drives
Ports: One RS-232C serial and two parallel; NTSC and RGB on graphics board
Dimensions: System unit: 20.7" x 15.3" x 6.4"; Keyboard: 17.7" x 7.7" x 1.7"; Display: 15.2" x 13.7" x 12.5"
Operating System: MS-DOS **Documentation:** Bound applications guides
Summary: The first delivered IBM PC AT compatible offers excellent performance. The lower price and extras that IBM left out provide a big inducement to MIS/DP managers and upscale professionals
Price: 512K, graphics board, and two floppy drives $4500; RGB color monitor adds $595
Manufacturer: Kaypro
533 Stevens Ave.
Solana Beach, CA 92075
(619) 481-4356

i, i, Sir

The "i" stands for impressive. The dark gray exterior, not to mention the large footprint of the system unit, make it look imposing. Indeed, it consumes desk space, but the speed and power of the machine more than compensate for the size.

Like the AT, the 286i consists of three components: a display, a detachable keyboard, and a system unit housing the cpu, disk drives, and electronic wonders of the system.

The heart of the 286i is the 80286 microprocessor operating at 6MHz. This speed demon is supposed to run three times faster than an IBM PC. A comparison of the results of Ahl's Simple Benchmark (see July 1984 for a full explanation) in Figure 1 confirms this. It even runs a bit faster than the IBM PC AT. And for those with real number crunching needs, the computer supports an 80287 numeric co-processor.

	Time	Accuracy
IBM PC	24 seconds	0.1159668
IBM PC AT	9 seconds	0.1159668
Kaypro 286i	7 seconds	0.0058594

Figure 1. Benchmark Test Results.

The 286i comes with 512K RAM on the motherboard, expandable to 640K (the limit recognized by MS-DOS). The chip itself can address 15Mb, but the RAM actually installed in the machine

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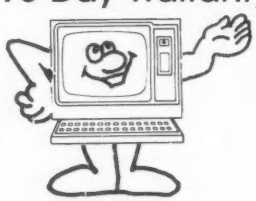

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depends on your use of expansion boards. Although equipped with eight internal expansion slots, the machine uses one for the disk drive controller, one for the video and parallel port, and one more for a serial port and second parallel port. In general, any expansion board that works in the IBM PC AT should also work with the Kaypro 286i.

Two 1.2Mb, 5.25" floppy disk drives are standard, compared to the single drive offered by IBM. These 96 tracks per inch (tpi), high-density drives can read regular 48tpi, 360K disks, so your old IBM PC software can be used on the 286i. Kaypro leaves space in the system unit and provides ribbon cables on the drive controller board for installation of an internal Winchester hard disk drive. Several third-party manufacturers offer such drives, which range in size from 20Mb on up.

Like the AT, Kaypro eliminates DIP switches on the motherboard in favor of a software program. Kaypro also includes a security lock and key to keep unauthorized people from using the system.

All the good things we said about the detachable, slant-adjustable keyboard on the AT come back to please us on the Kaypro. This includes improved layout; enlarged Shift and Enter keys; some use of English labels; Enter key on the numeric keypad; LEDs for the Caps Lock, Num Lock, and Scroll Lock keys; and a generous length of coiled cord to connect the keyboard to the system unit.

The tactile and aural feedback are more subdued than either the PC or AT keyboard. The touch is softer, and the key clicks are fainter.

The 286i does not come with a monitor, although Kaypro does sell a 13" RGB color monitor in the same dark gray color scheme. This made-in-Japan monitor performs admirably and certainly passed our monitor torture test (see February 1985 issue for details of the test).

Character resolution is 25 rows of 80 characters, and graphics resolution is standard IBM 640 x 200 pixels using high resolution graphics (black and white) and 320 x 200 pixels using medium resolution graphics (four colors). The dot pitch is 0.4 mm.

Software Included

Kaypro bundles an incredible amount of software with the 286i—all of it from MicroPro International. This full-scale package consists of the *WordStar* word processor, *InfoStar+* database management system and report generator, *MailMerge*, and *CalcStar* spreadsheet—all under the *StarBurst* program umbrella. Also included is a version of GW-Basic that emulates BasicA.

Thus, everything you need to set up a productive computer system comes right out of the box with one exception: MS-DOS. At this time, Microsoft has not yet released MS-DOS 3.0. You must buy PC-DOS 3.0 (which works quite well on the 286i) from IBM.

Of course, the real test of the Kaypro is whether it will run off-the-shelf IBM software. Heading the list is *Lotus 1-2-3*, which also happens to be the de facto standard of IBM PC compatibility. The 286i ran version 1A at lightning speed with absolutely no problems. The other paragon of PC compatibility, Microsoft *Flight Simulator*, did not fare so well. Our copy, version 1.05, booted correctly. However, while you could select the preliminary system parameters and hear the engine, the plane did not fly. Kaypro points out that *Flight Simulator* does not run on the IBM PC AT either—a fact duly reported in our review of the AT.

Other business, education, and entertainment programs ran without error; our tests indicate that the 286i runs much of the PC software. Be forewarned that many programs are speeded up, however. In most cases, this is an advantage, but sometimes the speed disrupts program timing.

Thus, we must repeat our standard caveat: try the software before you buy the hardware. If the bundled software is all you need, then have no fear. But if you intend to use your own software, take a copy to your dealer and test it. This simple step may save a great deal of post-purchase frustration.

Pricing

Kaypro, long a low-cost leader with portables, is now aiming at the price-conscious professional.

The base model with 512K RAM, two 1.2Mb floppy drives, one serial and two parallel ports, and graphics board costs $4500. The RGB monitor retails for $595.

Indeed, ATtractive

Give Kaypro credit for providing an excellent IBM PC AT compatible. It offers speed, PC software compatibility, a good keyboard layout, and bundled software at a truly competitive price. ■

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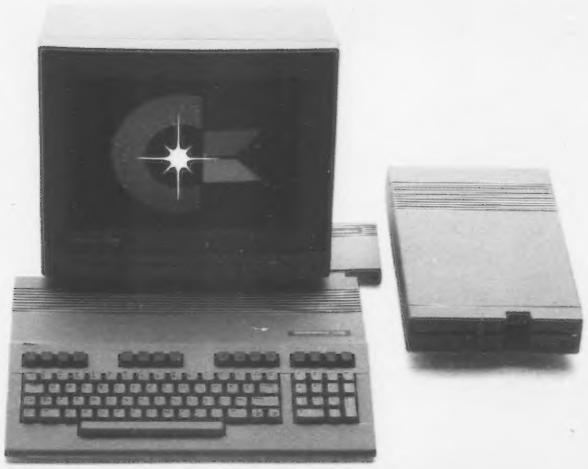

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Commodore 128

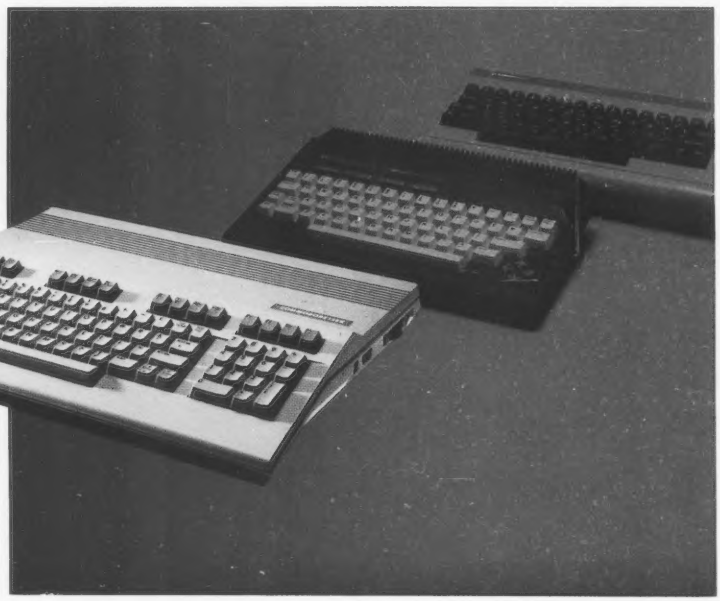
Capability and compatibility in Commodore's new flagship/**John J. Anderson**

We begin with a quote. The following appeared in "Commodore's Port," in the December 1984 issue of *Creative Computing*. I had just finished extolling those virtues I could find in the Commodore Plus 4, nee Model 264. It didn't take very long. I followed up with some suggestions for the future.

"So Commodore, what to do? I will tell you, okay? Take the C64, slap another 64K of bank-switched memory into it and squeeze it into a sexy case. Improve the keyboard by arranging it into a Selectric-style layout and bettering its feel. Take the excellent Basic from the Plus-4 and build it into the new 'C128,' adding special sprite and SID commands as in Simon's Basic. Keep the directional cursor keys and function keys across the top, as well as the built-in machine language monitor. Return to the port configurations of the past [the Plus-4 used incompatible joystick, ROM cart, and user port jacks]. Make sure all the machine language disks and ROM cartridges designed for the 64 run beautifully on the C128. And price it at $400 list."

It didn't take crystal balls to write those paragraphs. Just some common sense. What amazes me is that Commodore itself reached back and found the common sense to follow up with a product very close to those specifications. The Commodore 128, released as we go to press, lacks a Selectric keyboard and directional cursor keys, but in its major aspects closely resembles the machine described above.

The C128 draws on the heritage of the C64 and the inspiration of the Plus 4. It can operate 100% compatibily as a C64. It can operate as a 128K super-Basic machine with high level commands that bring the power of the machine easily to hand. And it offers CP/M compatibility as well. Alongside the 6502-family 8502 processor that forms the heart of the C128, resides a Z80 processor capable of pumping out a color 40- or 80-column display.



Photography by Jeff MacWright.

Hardware Profile

Name: C128
Type: Personal computer
CPU: 8502, Z80
RAM: 128K
Display: 80 columns (RGB mode), 40 columns (composite mode)
Ports: ROM cartridge, cassette, serial DIN, video DIN, RF out, RF L/H toggle, DB-9 female, two joystick
Dimensions: 16.9" x 12.5" x 2.2"
Documentation: Extensive user's manual
Summary: Magnificent machine is three-computers-in-one
Price: $300
Manufacturer: Commodore Business Machines, Inc.
1200 Wilson Dr.
West Chester, PA 19380
(215) 431-9100

Keyboard and Case

Curmudgeon that I am, I was somewhat unhappy with the keyboard of the C128 even as I revelled in its beauty. The C128 itself is undeniably a real looker—it is indeed "sexy," if hardware can be so described. And yet the directional cursor arrows of the Plus-4 are gone, replaced with nondirectional arrow keys which supplant, but do not replace, the traditional "shift" cursor keys Commodore has foisted on us for so long (and which have always driven me utterly mad). There also, like an old acquaintance you'd rather not have run into again, is the Commodore-standard non-Selectric key character layout: quote marks such as SHIFT-2, apostrophe as SHIFT-7. If you are moving up from a Pet or C64, you

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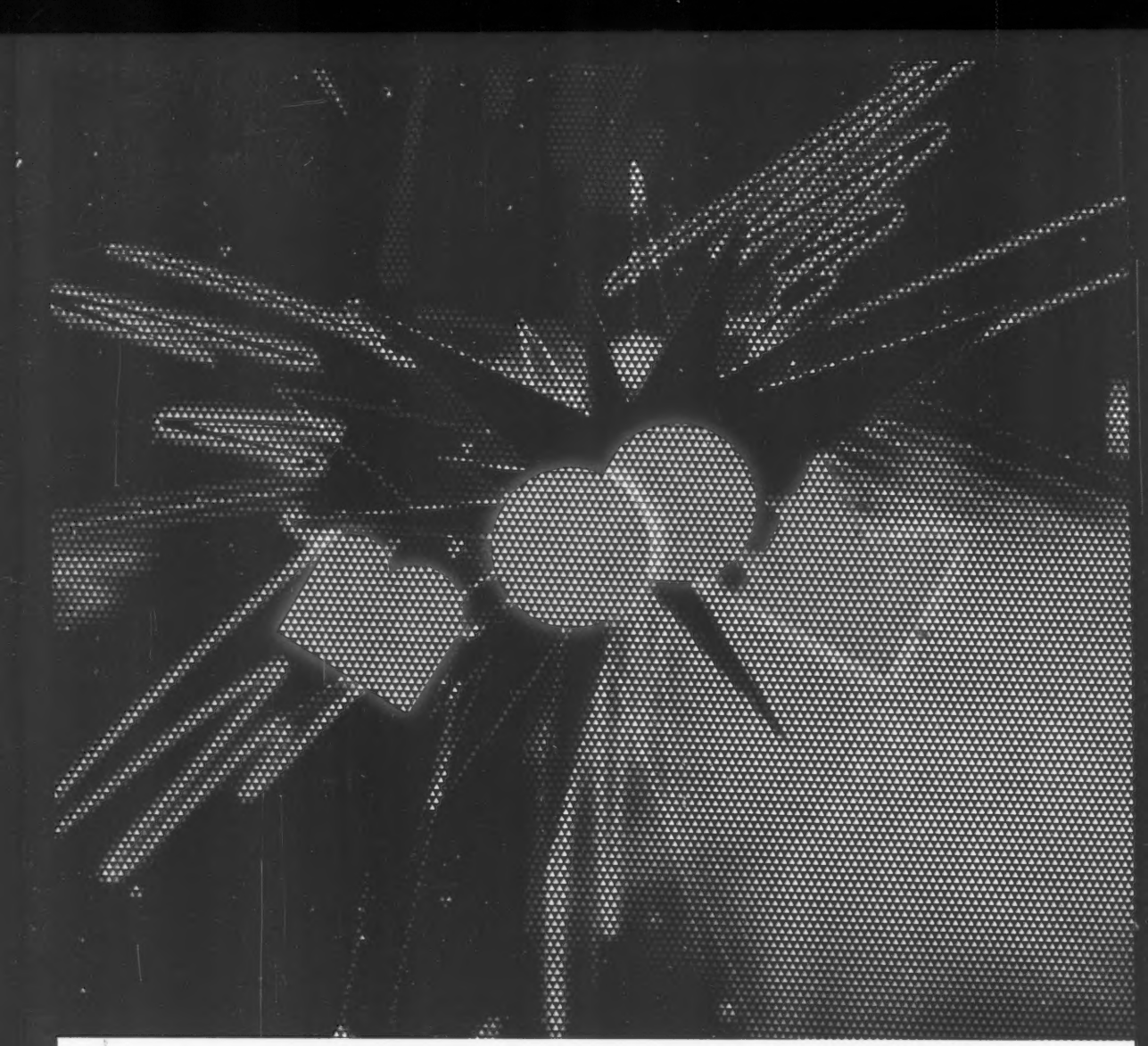

Business Week readers knew about the computer war before the first shot was fired.

Back when most people were touting the boom in personal computers, people who read Business Week were looking ahead to the fireworks that would follow.

They knew price wars were on the way. There would be battles for shelf space. The struggle for more software would be hard fought. And they knew that few of the companies trying to cash in on the new industry would survive.

In fact, long before the computer war broke out, Business Week readers not only knew it was coming, but who would come out on top.

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will feel totally at home. But the question arises: must we live with this forever?

Keyboard feel is acceptable if slightly squishy, and key travel is deep with a positive touch. The sculptured keycaps feel good to the fingertips, and gone is the "overinflated" feel of the C64. As they do on the SX-64 transportable, the keys feel somewhat loose. This can be disconcerting, but causes no real harm —they are not about to actually come off. Unlike the SX-64, the SHIFT-LOCK key is without an LED on the C128. The presence of a numeric keypad is a pleasant addition, although it emulates a VDT-100 terminal and so returns different keycodes than the regular number keys. Hence the keypad cannot be read directly in the C64 mode. Don't despair, C64 programmers; I'm sure there is a way around this.

A few new dedicated function keys debut on the C128: ESC, TAB, ALT, CAPS LOCK, LINE FEED, 40/80 DISPLAY, and NO SCROLL. TAB and ESC were certainly sights for sore eyes. More than any other physical features of the C128, the key 40/80 DISPLAY suggested to me Commodore's desire to take on the Apple IIc. Why upon power-up, the C128 even defaults to a pseudo "green screen" color display.

The C128 and the Apple IIc have another feature in common—both are wider than their keyboards by quite a few inches but are too narrow to support the placement of a monitor upon them. The IIc offers a custom stand to circumvent the problem with its matching green-screen monitor. I imagine a similar arrangement that would work out very well with the C128. As it stands now, however, set aside some space on your desk. The C128 is as low-slung as an Italian sports car, but commands the footprint of a small moving van.

Like the Plus-4 before it, the C128 has broken one long-standing Commodore tradition—it sports a true RESET key. The key is recessed—really more of a button. I can't imagine pressing it accidentally. It is a welcome addition and proof positive that just because things have been done one way since the beginning of time, nothing says they can't be changed. Thanks, fellas. Now again, about that key character placement...

You'll find the back of the C128 case much like that of the C64—ROM cart port, cassette port, serial DIN, video DIN, RF out, RF L/H toggle, and user port. The only addition here is a standard DB-9 female connector for RGB output. The C128 will output 80-column color or monochrome RGBI in 128 and CP/M mode. On the righthand side of the machine you'll discover two joystick inputs, the power input, on/off switch, and that lovely little reset button.

Very fortunately, all the connectors I have just described remain compatible with those you may already be familiar with on the C64. Among the more fetid design shortcomings of the Plus-4 was its entirely incompatible set of connectors, ranging from joysticks to ROM slots. Happily, Commodore has realized that the key to riches is not to be found by forcing you to buy a different kind of joystick.

Power Supply

Virtually the only connection that has been modified is that of the power supply, and that decision was wisely made to keep you from using a C64 power supply with your C128. Here again the C128 shares a common feature with the Apple IIc—the external power supply is big, off-white, and heavy as a cobblestone. One look at the C128 power supply bespeaks a commitment to quality—a topic I'll be getting back to up ahead. It is a switching power supply, not just a bridged transformer. It sports an external fuse and is built to take a little punishment. It weighs about five pounds, so kicking it is more likely to damage your own foot.

C64 Mode

In the C64 mode your C128 turns itself into a bona fide C64. Up comes the familiar blue-on-blue screen with Basic 2.0 and 38911 bytes free. Using a 1541 drive, we were able to boot every Commodore disk in the lab. ROM cartridges scored less than 100%, however—sprites were scrambled on our Commodore *International Soccer* program. Otherwise everything ran without incident. (This may not be the case with the new 1571 disk drive—see sidebar.)

So unlike the advent of the Atari XL series, which was largely but not totally compatible with its ancestor models, causing all sorts of ancillary grief, the C128 houses an unadulterated C64 in its bowels. Score one for Commodore Business Machines.

Theoretically, however, to keep the 64 mode inviolately compatible, you can't get any of the super stuff of the C128 to run there. However, the shift between operating modes can be accomplished in software, and there is no reason I can think of why the power of

1571 Breaks the Time Barrier

Peter H. Lewis got off a particularly good line in a recent installment of his peripherals column for the *New York Times*. He said: "It is conceivable that a child could grow up waiting for a program to load on a Commodore 64, the Galapagos tortoise of computers."

Yes, there is humor there, but there is really nothing amusing about sitting and staring at a blank screen for four minutes, while data crawls from the drive to the computer at 320 cps. And that is just about the speed of the Commodore 1541 —not much faster than a good cassette drive.

With the introduction of the 1571 disk drive, Commodore hopes to silence the turtle jokes forever.

The 1571 looks very good alongside the C128 with its matching low-slung design and wide footprint. It is dual-sided and therefore can hold 340K or twice the data of its predecessor, the 1541.

You can use the 1571 compatibly with a C64, but it will not work any faster. It is alongside the C128 that it truly shines, working over four times faster than the 1541. Jim Gracely of Commodore has hinted at even faster "burst" modes with speeds up to a whopping 12,000 baud.

Loading CP/M from a 1541 into the C128 took 1:54 of noisy spin time. The 1571 booted the same modules in 43 seconds, and did so extremely quietly. CP/M itself executes 10 times faster on the 1571 than on a 1541.

In his technical overview of the C128 in the April 1985 "Commodore's Port," Sheldon Leemon reported that there might be a problem booting exotically-protected programs on the 1571. Unfortunately, at press time we had not had a chance to try booting much on the 1571. We will follow up in "Commodore's Port."—*JJA*

the 128 cannot be tapped in some sort of pseudo-64 mode (my very good and technically-minded friend Sheldon Leemon may feel differently on this score, and our debate on the topic is sure to turn up in "Commodore's Port"). As I mentioned above, it is probably possible to get that numeric keypad working in 64 mode with an ML subroutine. I think it must also be possible to set up some sort of RAMdisk to run C64 programs concurrently. Commodore programmer/pundits surely have their work cut out for them for the next year or so.

The CP/M Mode

In my years with *Creative*, I have tried to earn a reputation for frankness, and here is another opportunity to be bracingly candid. No one in the micro industry could be less enthusiastic about CP/M than I am. That is not to say I think it is terrible—I just don't think about it. I subscribe to a perspective I first read as a typo in an unsolicited manuscript: "CP/M is great, if you've never used it."

Therefore, it would have made no difference at all to me if the C128 had not been CP/M compatible. Suffice to say that many facets of C128 CP/M will be of interest to CP/M fans. First off, the new 1571 drive from Commodore, described in a sidebar to this piece, can read Kaypro, Osborne, and IBM CP/M disks, and the C128 can run them. This opens the C128 software library to hundreds of useful programs already available. Also, the VIC and SID chips within the C128 can be accessed from CP/M; CP/M can operate in 40- or 80-column modes; and the numeric keypad is operational within it. Using the RAM expansion described ahead, C128 CP/M can address up to 512K.

C128 Mode

Reasonably, by far the most exciting mode available on the C128 is the C128 mode. Shift into 128th gear, and you're in overdrive. Now the dedicated function keys are online. Fully 48K of ROM is also on tap, and the screen reads Basic Version 7.0 with more than 122K bytes of RAM free!

Now wait a minute, right? The 6502 family of microprocessors can access only 64K of RAM. So we have to play some tricks to address twice that much. Easy: we'll bank-select, swapping chunks of RAM underneath the nose of the MPU. Fact is, the C128 will be expandable externally to 512K of bank-select RAM memory through a magic box yet to be announced by Commodore. ROM can be expanded through the ROM port to a maximum of 112K. A custom memory management chip allows sophisticated manipulation of memory banks. For example, the actual text of a Basic program always resides in the first 64K bank of the C128, while strings, arrays, and variables always reside in the second bank. This is enough room to create the most mammoth Basic program you can imagine without running the risk of any program stepping on its own feet.

And, boy, what a Basic. The list of more than 140 Basic commands at hand in C128 mode reads like a hobbyist's dream. They pick up where Simon's Basic left off and finally put real graphics, sound, and programming power into the hands of the novice programmer. Gone are the cryptic load and save commands; meet DLOAD and DSAVE. Type RUN "PROGRAM" and your program loads and runs. Type HEADER "DISK" and your disk formats. It's enough to bring tears to the eyes. Among the powerful new commands are COLLISION, DIRECTORY, ENVELOPE, PAINT, RENUMBER, and WINDOW (see Figure 1).

Need help while programming in Basic? Press the HELP key. The offending line will list automatically, with the syntax choke highlighted in inverse.

The C128 redresses another long-standing Commodore peeve. Brace yourself—it can actually autoboot a disk. The command BOOT can be used to denote a boot file. Then all you have to do is put that disk in the drive and power up, like any Apple, Atari, or IBM, and your program will autorun.

It occurs to me that this would be another lovely spot to get a little of the magic of the 128 mode to spill over into 64 mode. Imagine, no more typing of LOAD "*",8,1 RETURN RUN RETURN. Get on it, somebody!

In fact, the C128 is smart enough to detect from disk track 0 what kind of disk you have in your 1541 or 1571, or if you have a ROM cart inserted, and act accordingly. Amazing, eh? Seems like the computer that began as the Vic, matured into the C64, and served a brief stint as the Plus-4, is finally a finished product. Praise the baud and pass the parameters.

In addition to Basic, the neat little machine language monitor that made its debut in the Plus-4 is also present in ROM in the C128—perfectly serviceable for nosing around in memory and disassembling machine code.

Command	Function
AUTO	auto line-numbering
BACKUP	back up one drive to another
BANK	select memory bank from software
BOOT	make a program into boot file
BOX	draw a box on the screen
CATALOG	obtain disk directory
CIRCLE	draw circles and ellipses
COLLISION	detect sprite collisions
DIRECTORY	same as CATALOG
DLOAD	load a program from disk
DO/LOOP/WHILE/ UNTIL/END	allow structured loop control
DSAVE	save a program to disk
ENVELOPE	define sound envelope for SID chip
HEADER	formats a disk
HELP	shows line where error occurred
KEY	define or list function key
MONITOR	enter machine language monitor
MOUSPR	locate or move sprite
PAINT	fill area with color
PLAY	define and play musical notes
PRINT USING	format print output
PUDEF	redefine symbols in PRINT USING
RENAME	rename files
RENUMBER	renumber lines of Basic code
SCALE	alter scaling in graphics mode
SLEEP	delay program for specific duration
SOUND	create and output sound effects
SPRDEF	allow automated sprite design
SPRITE	define sprite attributes
TEMPO	define musical note duration
TROFF/TRON	Basic program trace function
VOL	set sound output volume
WINDOW	define screen window

Figure 1.

Needless to say, the VIC and SID chips are totally accessible from the 128 mode. In addition, another video chip, the 8563, can provide an 80-column, 16-color RGB display in the 128 mode. Resolution in 80-column mode is 640 x 200. Graphics are not currently supported from Basic in 80-column mode. This can, however, be done through ML.

Specs on composite graphics from the 128 mode match those of the C64. However display quality has been improved, although those faint vertical lines which have plagued C64 backgrounds from the beginning of time have not fully disappeared. A little maddening, but the best Commodore screen quality yet.

Speed

Speed has never been one of the greatest features of Commodore

computers, and the C128 is really not an exception to that rule. The Ahl Quickie Benchmark results were: accuracy, .00010414; random, 5.48137. A conservative estimate might clock the machine at 1.5 MHz, and a little faster in CP/M mode.

More significant is the fact that the new Commodore 1571 drive can cut down disk access time significantly. The C128 runs perfectly with the 1541 drive, but is then as awfully slow as the C64. However, paired with the new drive, the C128 is dramatically faster. How much faster, you ask? Up to ten times faster (see sidebar). Running alongside a 1571, the C128 is plenty fast enough.

The Bottom Line

The C128 is the rightful heir to the flagship position in the Commodore line. It is a beautiful machine, and nearly everything about it is right. The best compliment I can give is to state that I will be spending lots of time with it.

Some critics have cast aspersions on the model 128, questioning whether software developers will actually make use of many of its new features. Experience within and without the industry has undeniably shown that the lowest common denominator tends to set the standard. In other words, new packages will continue to be designed to appeal not only to a small group of new C128 owners, but to the mammoth installed base of C64s. So why buy anything more than a C64?

Well the incredible Basic built into the C128 gives an eloquent response to that question. Here is a machine that gives a computer hobbyist about as much power as he is likely to get without committing to assembly or C. And on that score, the C128 is a very good argument for a new computer, whether you are computing to learn or for pleasure.

We began with a quote, and so we shall end with one. This paragraph followed directly on the heels of the ones I quoted up top, way back in December 1984:

"And oh yeah, one more thing. Have the design experts work whatever overtime it takes to give the C128 an extremely low return rate. Design it to work. That will give it an image that the C64, for all its features, has as yet failed to attain: one of true quality."

I believe it is upon that one factor, more than upon new software or even pricing, that the success or failure of the C128 ultimately depends. If the new models start coming back the way the early 64s did, the C128 will never gain the respect of, or a decent foothold in, a now highly price- and quality-conscious marketplace.

I have the emphatic assurances from everyone I have spoken to at Commodore that the C128 has been designed to work and to keep on working—and that quality control on the assembly line has been the keyword in production of the C128. If this is true, I think the C128 will be a strong contender among a new generation of low-end micros and a favorite of many hobbyists—not only those already in the Commodore camp, but from across party lines as well. ■

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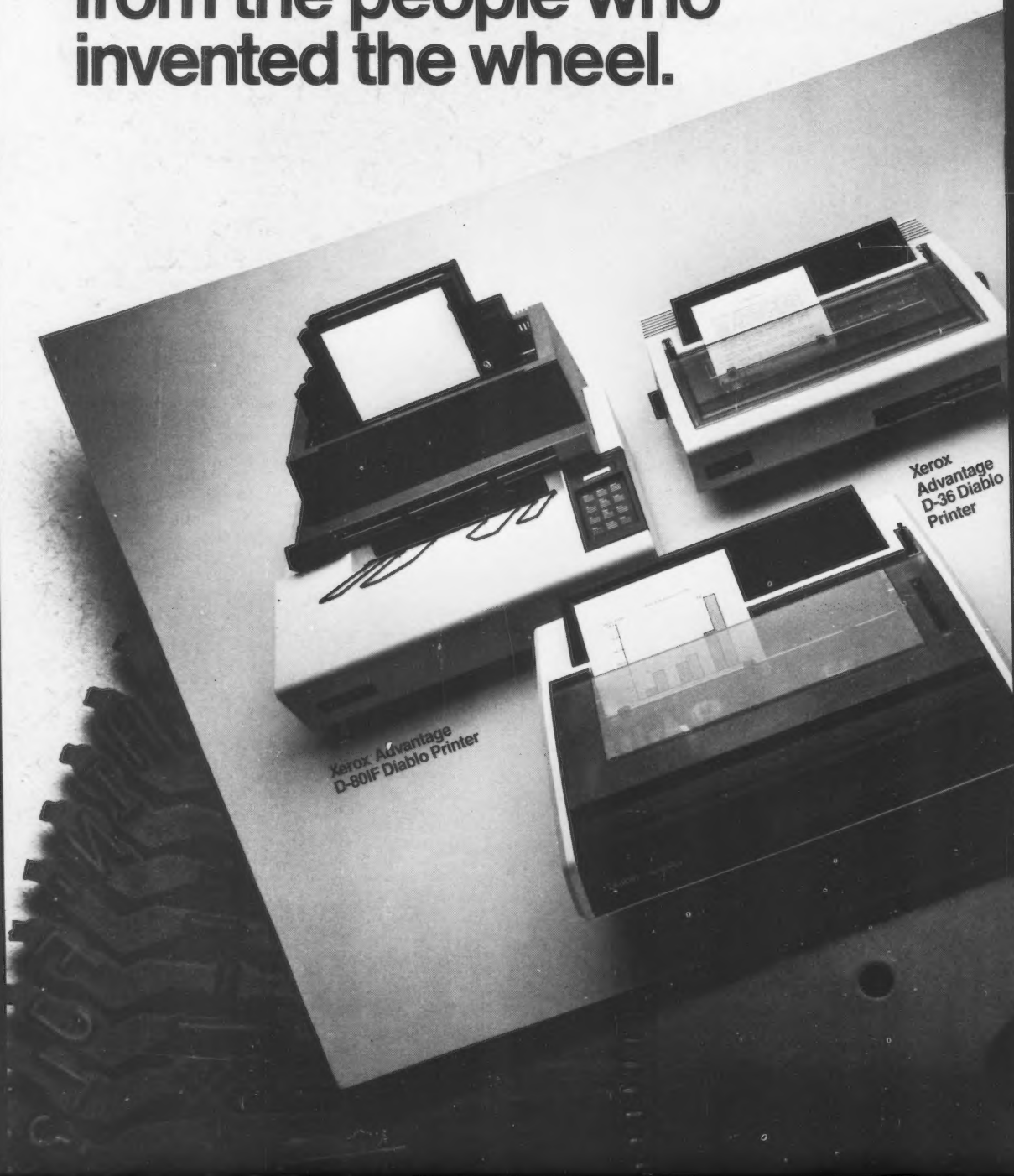

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Affordable High Quality Printers

24-pin technology offers near letter quality at dot matrix speed/**Bob Covington**

The new generation of 24-pin printers from Brother, Toshiba, Fujitsu, Epson and others offer excellent print quality and save you money, time, and desk space. While laser printer prices hover in the stratosphere, 24-pin printers are an affordable option, offering draft and letter quality printing in the same box. With almost three times as many print elements as 9-pin printers, the new machines produce copy very close—and in some cases, equal—to that of a daisywheel printer, while retaining all of the benefits of a dot matrix device.

A good, high speed daisywheel printer (about 55 cps), can cost $1800 or more and print only text. Yet a good 24-pin printer, selling for as little as $1500, can do text and graphics—in color too. And it can do it all much faster than a daisywheel can, zipping along at a time-saving 80 to 96 cps (or more) in letter-quality mode, 288 cps in the high speed draft mode.

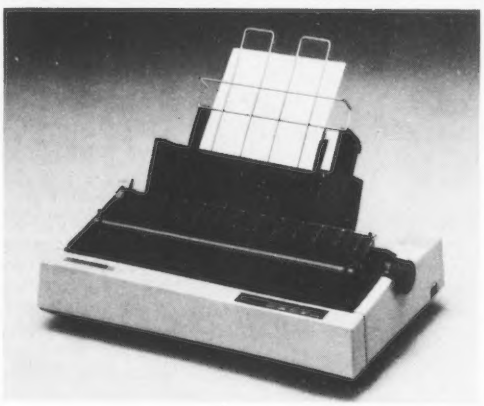
There are many advantages to 24-pin technology. With one printer doing the job of two, you obviously don't need as much room for equipment. Clearly too, a multi-function printer doing both dot matrix and letter quality work costs less than two separate printers.

Here we look at the three most recent arrivals on the 24pin scene: the Brother 2024L, the Epson LQ1500 and the Fujitsu DotMax 24. Literature from all three manufacturers claims letter quality output, but only the Fujitsu met the test. I found the output of the Epson and the Brother close, but not quite letter quality. The Brother 2024L won in the quietness category, however, and the Epson took all around awards for documentation.

The Toshiba 1350, first arrival on the 24-pin scene, is reviewed in the March 1984 issue of *Creative Computing*. At the time we praised the 1350 for its flexibility, outstanding print quality, and excellent graphics capability (fonts, pitch, and speed are software selectable). We also liked the built-in parallel and serial (RS-232) interfaces, but felt the documentation was overly technical.

The 1350 has been replaced by the 1351, which has all the features of the 1350 plus downloadable fonts. It retails for $1895. A virtually identical machine is available from Tandy as the DMP 2100P and sells for $1995. Toshiba also markets a smaller, 80-column printer, the 1340, which sells for $995.

Brother 2024L



Brother Industries has made quite a name for itself in typewriters, daisywheel printers, and portable printers. Their machines have a reputation for good design and ruggedness. The 2024L is well built, but its designers missed a couple of obvious points. Its list price is $1495.

Five front panel switches control Select, Top of Form, Font, Print Mode (Word Processing or Data Processing) and Linefeed. By pressing the Top of Form button lightly, you can advance the page in increments of 1/180th of an inch, allowing fine line adjustments. There are indicator lights for 10 pitch, 12 pitch, proportional spacing, high speed mode, and power on/error conditions, such as running out of paper. Print speed is rated at 160 cps in draft mode, which is double the 96 cps letter quality rate. The printer has a 16" carriage.

The footprint is a fairly large 22.4" by 15". The printer handles both tractor feed paper and single sheets. The latter mode often did not bring the sheet in far enough, causing numerous paper crunches during the evaluation. This is odd considering how much experience Brother has had with similar mechanisms on other printers.

Turning on the 2024L (the side-mounted power switch is inconveniently located) activates a cooling fan and sends the printhead through a short alignment routine. Printing is straightforward: logic seeking and bidirectional as you would expect. There are eight international character sets in ROM along with the usual complement of ASCII characters. The quality of the print, while good, retains a slight dot matrix look. For example, the curve in a lowercase "s" prints as a jagged diagonal rather than a curve. Output from the Brother is good enough to satisfy many users, but should probably not be considered a substitute for daisywheel print for those who require very high quality output.

The 2024L has emphasized, double-strike, shadow print, underline, condensed, wide and super- and subscript. For graphics, it offers normal, dual, and triple density bit image printing.

The printer comes with a one-line buffer and no provision for expansion.

Hardware Profile

Name: Brother 2024L
Type: 24-pin dot matrix
Feed: Tractor and friction
Speed: Draft, 160 cps; letter quality, 96 cps
Interface: Serial or parallel
Graphics: 288 dots per inch **Buffer:** 16K
Logic Seek: Bidirectional **Character Sets:** 7
Summary: Print quality fine for everyday correspondence
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Manufacturer: Brother International Corp.
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Boldface
Condensed
Double-strike
Danish: Jeg har ikke
fået søvn i øjnene
160 cps draft mode
Underline
Wide print

Brother 2024L print sample.

This is downright stingy in a printer costing $1500. Somewhere on the Brother 2024L circuit board there are two DIP switches that allow you to adjust critical parameters (such as linefeed and skip-perforation), but the designers placed these switches so far back that one set totally eluded me and the other was all but unreachable. Technician Bruce Deore at Brother's U.S. headquarters in Piscataway, NJ, thinks a fix is under consideration.

Finally, the Brother uses ribbons much too fast; a new ribbon began fading noticeably after 130 pages in the letter quality mode. At $99 per ten-ribbon pack, that comes to 7.5 cents per page!

The 2024L is liberally lined with acoustic foam, making it my choice where noise is the prime consideration. In fact, it is a very quiet printer, generating just 73 db measured four feet from the front panel. Options include a $299 cut sheet feeder for 8 1/2" paper; $399 for the wide 14" version.

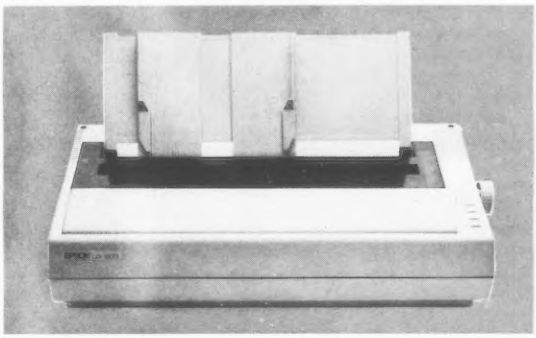
The documentation is adequate with one nasty omission: there are no instructions on how to remove the panel cover for access to the parallel cable connector. It took me about 20 minutes to figure out how to do it.

CIRCLE **403** ON READER SERVICE CARD

A True Double-Duty Printer?

Brother Industries is rumored to be showing distributors and OEMs what may be the ultimate in double-duty printers. As we went to press, we learned that Brother has developed a printer with two heads: a 36 cps daisywheel head for letter quality and a 9-pin 160 cps dot matrix head for drafts, graphics, etc.

When one head is in use, the other swivels away from the paper. Reportedly this approach has given ribbon designers headaches; there doesn't appear to be enough room for two separate ribbons. An expensive hybrid ribbon to cover both heads is being considered as is a paper feed mechanism similar to that of the Fujitsu DōtMax 24. The suggested retail price will probably be around $1300. *—BC*



Hardware Profile

Name: Epson LQ-1500 **Type:** 24-pin dot matrix
Speed: Draft mode, 200 cps; letter quality, 67 cps
Feed: Friction; tractor optional **Interface:** Optional parallel or serial
Graphics: 240 dots per inch **Character Sets:** 5 **Buffer:** 2K
Logic Seek: Bidirectional; unidirectional graphics
Summary: Print quality fine for everyday correspondence
Price: $1495; $95 parallel interface; $150 each IEEE 488 parallel and serial; $55 tractor feed
Manufacturer: Epson America
3415 Kashiwa St.
Torrance, CA 90505
(213) 539-9140

Epson LQ-1500

The Epson LQ-1500 manual boasts of 224 types styles. The output is very good, but still unmistakably dot matrix. Practically speaking, the Epson, like the Brother, is fine for the user who needs better print quality than ordinary dot matrix. It easily meets the requirements for term papers, reports, abstracts, and everyday correspondence—applications requiring a neat, but not fancy appearance.

On the power up, my LQ-1500 lets me know it is there by idling with a nasty high pitched whine in a range somewhat below that of a dog whistle. Hopefully, this was just a flaw in the test unit; it stopped when I pressed the rear cover firmly inward. Like the Brother, the Epson has a loud, but not distracting cooling fan.

Oddly enough, the LQ-1500, which retails for $1495, does not come equipped with an interface, so set aside some extra money for this item (parallel or serial) which installs easily in minutes even though, like the missing buffer on the 2024L, it should have been included. The parallel interface sells for $95; the IEEE 488 parallel and the serial, for $150 each. Front panel controls handle Form Feed, Sheet Feed, On-Line and Linefeed. LEDs indicate power, ready, paper out, and on-line status.

Proportional
Letter Quality 10 cpi
Letter Quality 12 cpi
Boldface
Condensed
Double-strike
200 cps draft mode
Italic font
Underline
Wide print

LQ-1500 print sample.

In draft mode, the LQ-1500 is rated at 200 cps. The manufacturer claims 67 cps for letter quality mode, but critical movements (such as linefeeds and form feeds) are so sluggish that the overall effective speed of the printer is slowed considerably.

The LQ-1500 weighs 31 pounds and has a long, low profile measuring 23" across by 14" deep and 5" high. Typically for Epson, the documentation was excellent, fully indexed, and easy to read.

Options include a $499 cut sheet feeder and a $55 tractor feed mechanism. There is a 2K buffer on the interface board, and Epson's Debra Ward tells me a 32K buffer is in the works (it will probably have a suggested list of $175).

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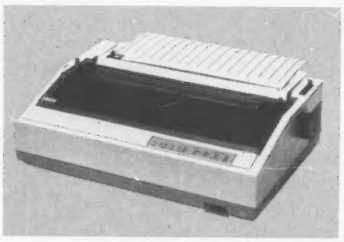

Fujitsu DotMax 24

The Fujitsu DotMax 24 is incredibly well-engineered with performance commensurate with its $1995 list price. The standard DotMax 24 comes with three interfaces: serial (with two way communications), parallel, and current loop. The DIP switches are all easily accessible along with other adjustment controls hidden under a small door on the front panel.

The output is very close to daisywheel print, so close that, during its tenure at The Covington Group, our daisywheel printer gathered dust. The speed of the DotMax 24 is equally impressive: 288 cps for draft mode and 96 cps in letter quality. The latter mode offers three typestyles: Orator, Courier and Prestige Elite. Descenders are clearly and distinctly drawn, and only the closest examination exposes the dot matrix origin of the characters.

One of the most innovative features of the DotMax 24 is its dual paper feed. The built-in tractor feed is designed to switch from fanfold to single sheets without requiring removal of the tractor paper—no more threading and unthreading tractor paper.

Front panel controls on the DotMax 24 allow for 1/180" forward and backward vertical movement, which is useful for fine adjustments of the paper position. Reset (to clear the 4K buffer), Form Feed, Linefeed, and On-Line switches are also provided. The Fujitsu designers were kind enough to put the power on switch on the front of the printer where it is easily accessible.

The DotMax 24 has auto justification, centering, super- and subscript, bold, emphasized, underline, wide print, and condensed print in ROM. It also has a front panel socket for optional ROM and RAM cartridges. Bit image graphics at 180 dots per inch are available.

All in all, the DotMax 24 is an excellent piece of engineering. Construction and performance are superb. If there is one problem, it is a minor one: noise. When idling, the DotMax 24 is completely silent; it has no fan. However, the machine generates a turbine-style crunching sound when printing. While registering only 76 db at three feet, the sound is jarring. This printer needs a cabinet if used in an office environment.

Options include ROM and RAM cartridges for different fonts ranging in price from $92 to $184. The full width sheetfeeder is $530. Fujitsu now has a four-color version of the DotMax 24 for $2145. The regular DotMax 24 is available with either Diablo or IBM code emulation for IBM graphics programs.

Documentation for the DotMax 24 has a budget look, but it is quite thorough and understandable.

The Fujitsu is clearly the printer to get if you need professional letter quality at dot matrix speed. However, if your needs are less exacting and close is good enough, either the Epson or the Brother should meet your needs at a lower price. ■

CIRCLE **405** ON READER SERVICE CARD

Hardware Profile

Name: Fujitsu DotMax 24
Type: 24-pin dot matrix **Feed:** Tractor
Speed: Draft mode, 288 cps; correspondence mode, 192 cps; letter quality, 96 cps
Interface: Centronics parallel; serial and current loop optional
Graphics: 180 dots per inch
Character Sets: 8 **Buffer:** 4K
Logic Seek: Bidirectional
Summary: Excellent print quality at high speed
Price: $1995
Manufacturer: Fujitsu America, Inc.
3055 Orchard Dr.
San Jose, CA 95134
(408) 946-8777

Proportional
Courier 10 font
Boldface
Condensed
Double-strike
Danish: Jeg fået søvn
288 cps draft mode
192 cps correspond
Orator font (with
proportional spacing)
Prestige font
Underline
Wide print

DotMax 24 print sample.

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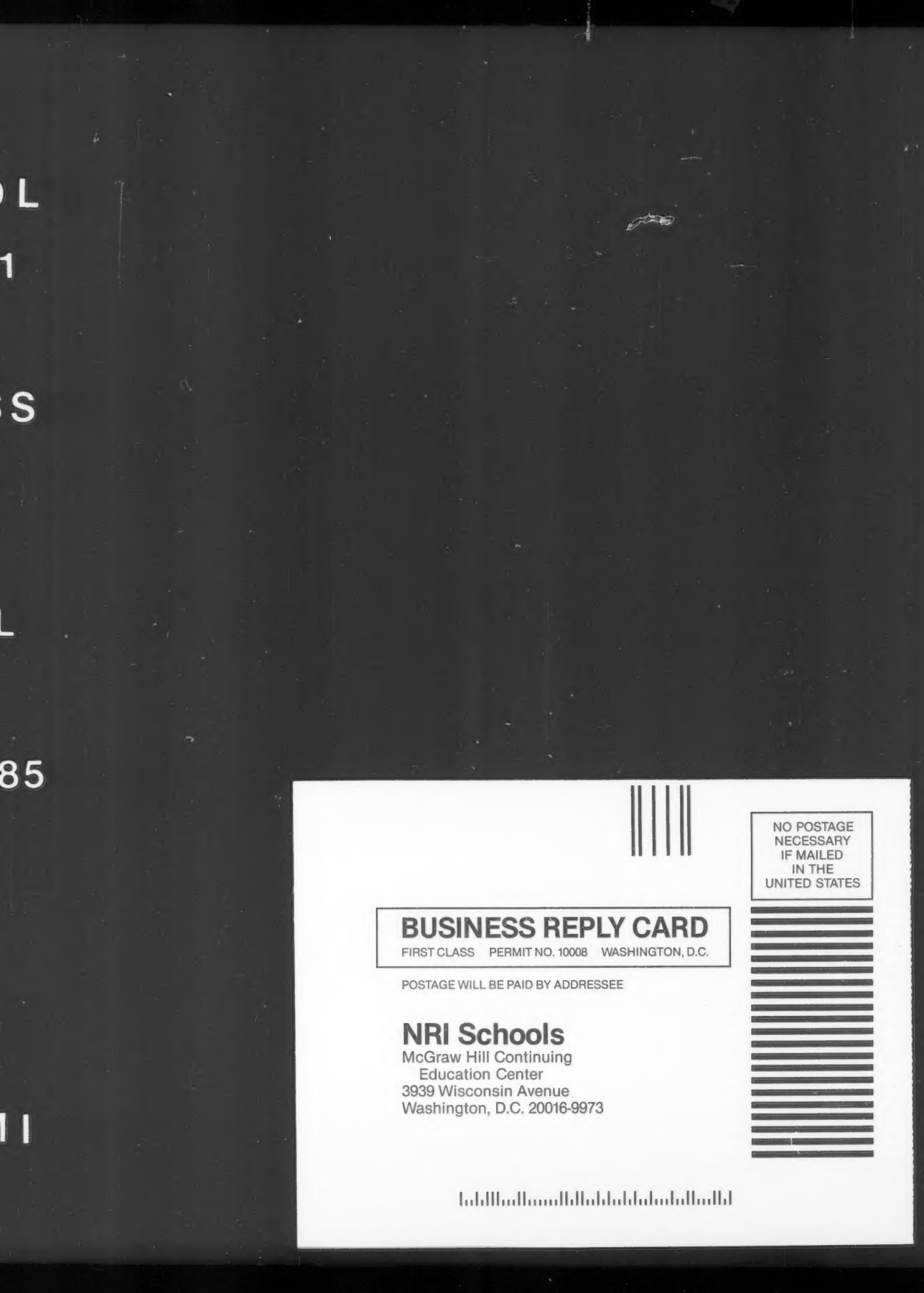

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CIRCLE 117 ON READER SERVICE CARD

Microsoft Word

A full-featured word processor for the Macintosh

Glenn A. Hart

One of the most eagerly awaited programs for the Macintosh has been the Microsoft *Word* word processor. As the Mac software drought has eased, Mac owners have been inundated with one database management program after another, but the only word processor available has been the *MacWrite* program supplied by Apple with each new Mac.

MacWrite is a rather primitive word processor at heart, saved by the beauty and intuitive operation of the standard Mac user interface. While it lacks many features standard in even simple word processors, *MacWrite* is so easy to learn and use that a tremendous amount of useful work has been done with the program. Serious wordsmiths, however, have long chafed under the limitations of *MacWrite* and have longed for something more powerful.

Microsoft *Word* has been a best seller on the IBM PC for quite some time, and has earned an enviable reputation for flexibility and competence. *Word* on the PC can be used with only the PC keyboard, but it is obviously designed for and works much better with the two-button Microsoft mouse. Thus it was natural to assume that the long-delayed Macintosh version would be well suited to the Mac environment and a real powerhouse.

Well, *Word* for the Mac has finally been officially released, and it is a strong implementation. *Word* is simply light years ahead of *MacWrite*, and brings serious word processing to the Mac for the first time. It is very well integrated into the Mac user interface, for the most part, yet it is reasonably easy to use. It is a thundering cliche that "with flexibility comes complexity," and *Word* is no exception, but the program is so well constructed that a beginner can do useful work without learning all the bells and whistles available. As the user's expertise and familiarity with *Word* increases, the fancy stuff is readily accessible.

Software Profile

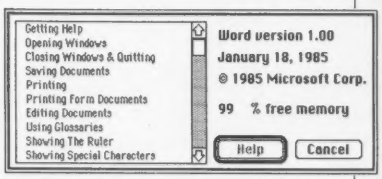
Name: Microsoft Word
Type: Word processor
System: Macintosh
Format: Disk
Summary: Superb word processing makes the Mac a serious business system
Price: $195
Manufacturer: Microsoft
10700 Northup Way
Bellevue, WA 98009
(206) 828-8080
(800) 426-9400

Functions and Features

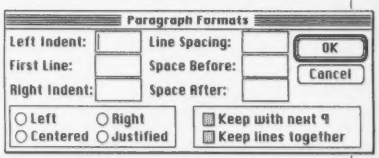
The basic *Word* screen is pure Macintosh—pull-down menus, scroll bars, and all. Minor deviations are a page number in the lower left of the horizontal scroll bar and a black bar at the top of the vertical scroll bar. Pulling down this bar reveals horizontal windows.

Scanning through the various pull-down menus begins to indicate the breadth of commands provided. Most of the File menu is standard Mac fare, but two of the options are unique. *Word* includes a powerful merge facility for printing form letters, legal documents, and other "fill in the blanks" projects. Simple commands are placed in the main document to indicate where blanks should be filled in. The actual data are stored in a separate file. The syntax is very straightforward and easy both to understand and to use. Conditional merging is included, so different segments of text can be printed based on the characteristics of an individual recipient.

Also on this menu is a Printer Setup option which configures both hardware and software to drive daisywheel printers as well as the standard ImageWriter. NEC, Diablo, Brother printers as well as the AppleDaisy and something called



Microsoft Word.



Paragraph Formats.

"typewriter" are supported. The printers can be connected either to printer or modem ports, and *Word* sets the baud rate (300 through 9600) and the pitch (10, 12, and 15 characters per inch and proportional spacing). The appearance of screen text varies based on the printer selected, so line breaks are shown correctly on the screen no matter which printer and pitch are selected.

Note that the new Apple LaserWriter printer does not appear as an option. *Word does* support the LaserWriter in all respects, but the printer driver is supplied by Apple with the LaserWriter and automatically appears as an available printer when the laser printer driver is installed.

The Edit menu uses the standard Macintosh Cut, Copy, and Paste commands to move text; Clear is also available to cut text totally without moving it to the clipboard. An Undo command reverses the last editing or formatting activity. An interesting wrinkle allows this command to delete or restore recent typing.

The Glossary function stores frequently used words, phrases, sentences,

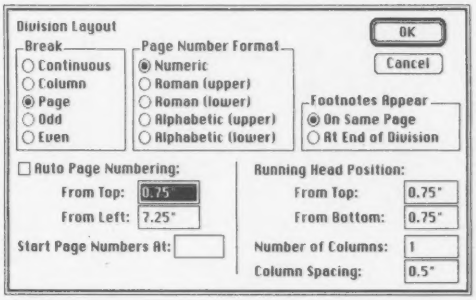
and paragraphs. A name of up to 64 characters is assigned to each snippet of text (although the names would obviously be kept short normally). Entering the name and a key sequence "expands" the glossary reference to the full stored text. The phrase Glossary works much like the PC version, although the procedure to save text into the Glossary is a bit more cumbersome.

The final Edit options control display of a ruler line which shows indents and tab settings, display of the normally invisible characters for end of paragraph, tabs, etc., and a Preferences option which permits changing the default measurement unit. *Word* normally measures everything in inches, but centimeters, P10's, P12's, or points can be chosen instead. P10's and P12's represent the length of one character when a document is printed at 10 or 12 pitch. The availability of points will become more significant as laser printers become more common. *Word* also can display text as it will be printed in the typeface or daisywheel font selected, or, alternatively, in a standard format which does not take the font selected into account. The user preferences selected are retained by *Word* and are in effect when the program is next used.

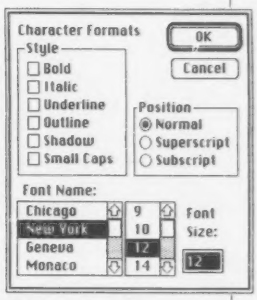
The Search menu offers Find and Change, both of which work as expected, and Go To, which is used to jump to a specified page. This only works if the document has been paginated by having been printed or if the Repaginate command has been issued. One of the few ways in which *MacWrite* is superior to *Word* is in automatic pagination and display of the header on each page.

The Character menu controls attributes like underlining and boldface. Calling these attributes from the keyboard is not as convenient as with *MacWrite*, because the Command sequences to invoke the attributes from the keyboard require multiple key depressions (e.g., Command-Shift-U for underscoring) in *Word*. On the other hand, a new style is available. Small Caps, a style often used for speeches, looks very much like the Orator font available on some daisywheel printers.

The keyboard commands to change font also allow changing the size of the font. Character formatting changes affect whatever text is selected. It appears that the special characters available with the Command key have been disabled, because the command key begins so many *Word* keyboard commands. This is a significant loss if the special characters are important to the user. Character font, size, and position can also be changed with a dialog box, which allows making multiple changes more easily than typing a series of keyboard commands. In fact, the *Word* method of changing fonts and selecting font size is noticeably easier than that of *MacWrite*.



Division Layout.



Character Formats.

The Paragraph menu and a Paragraph Formats dialog box allow extremely flexible formatting options. Paragraphs can be left or right justified, fully justified, or centered; single or double spaced; an extra line can be added before or after each paragraph. Left and right indentations can be specified, and the first line of each paragraph can be indented. The first line indent can be negative for hanging paragraphs. Keyboard commands also can indent paragraphs for outline structures, and the mouse can be used to move symbols on a ruler line to set margins as well. Groups of lines or paragraphs can be kept together across page breaks, so tables and other entities can be entered without worrying about breakup during printing.

The program is so well constructed that a beginner can do useful work without learning all the bells and whistles.

The Word tab facilities are unusually powerful. In addition to the normal left tab and the decimal tabbing offered on *MacWrite* and many other word processors (a decimal tab aligns decimal points and is helpful when typing charts and statistics), *Word* has centered and right tabs to center text around a tab mark or right align text. A leader character can be specified for any tab. The lead character fills the space up to the tab. Periods, hyphens, or underscores can be chosen in addition to the normal blank lead character. The period is especially useful for tables of contents and similar projects. Tab stops can be specified with the mouse by moving symbols on the ruler line or by entering the exact tab position from the keyboard.

The Document menu controls Division layout, footnotes, headers, and repagination. The *Word* concept of a Division is a useful idea not seen in other word processors. A Division consists of pages or segments of text which have a consistent design or layout. It can be of any length. Many aspects of page layout can be specified, including page numbering and positioning, the number of columns (*Word* can print multiple columns in a single pass) and the spacing between columns, where headers and footers appear, where footnotes appear, etc.

Footnotes can be numbered automatically, or a user-selected symbol can designate a footnote. Footnotes are renumbered if one is added or deleted. Footnote text usually appears in a special window, but is edited just like any other text. The footnotes can be of any length, and *Word* will automatically split very long footnotes over multiple pages if necessary. Footnotes can be printed at the bottom of the page on which they appear or grouped together at the end of the Division or document.

Word allows headers and/or footers of any length, and any character or paragraph formatting can be used in them. The program can position headers/footers differently on even and odd numbered pages, skip the opening title page, etc.

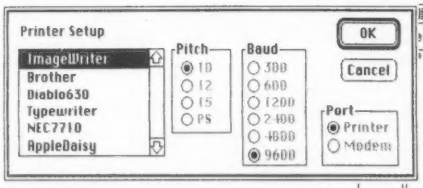
Operation

On the most basic level, *Word* is not terribly more difficult to use than *MacWrite*. Unless something special is needed, the user just types, makes corrections with the mouse or Backspace key and prints. There is no question that most beginners will find *Word* harder to use and more complex than *MacWrite*, but this is more a function of the many options that simply aren't available in *MacWrite*.

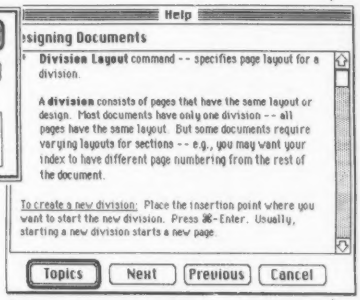
The learning process is eased considerably by the superb Microsoft documentation and a fine on-line Help system. Given that the *Word* documentation for the PC is abysmal, the excellence of the Mac documentation is rather a surprise. (I understand that new manuals for the PC version will be issued by the time this review appears.) The on-line help system is entered either by clicking the About Microsoft Word entry on the Apple menu or by typing Command-? The Apple menu method displays a menu of the available help topics from which the user can choose. Typing Command-? changes the cursor to a question mark; selecting any menu option displays help about the selected item. The help file takes a while to load in the first time it is called, but help is available much more quicky after this first time.

The use of the single button Macintosh mouse is rather different from the two-button Microsoft mouse used with the PC, but the concepts are similar and will be instantly familiar to Mac users. Microsoft has attempted to make as many commands as possible available through keyboard sequences. Their choice of key sequences is rather questionable, however. For example, Command-Spacebar inserts a nonbreaking space (a space which the program cannot use for breaking a line and wrapping a word down to the next line) and Command-Hyphen inserts an optional (conditional) hyphen. These are seldom used actions which could probably have been assigned more usefully to other functions (i.e., attribute assignment).

Many Mac users feel Apple went a bit too far in not putting any cursor control keys on the keyboard. The mouse is wonderful and makes many editing jobs much faster, but it *can* slow things down if you have to move only a character or so. Microsoft has added keyboard commands to move the cursor a character or word at a time. The sequences use a diamond-shaped cluster of keys, obviously inspired by *WordStar* except that keys on the right side of the keyboard rather than the left are used.



Printer Setup.


Help
sigining Documents
Division Layout command -- specifies page layout for a division.
A division consists of pages that have the same layout or design. Most documents have only one division -- all pages have the same layout. But some documents require varying layouts for sections -- e.g., you may want your index to have different page numbering from the rest of the document.
To create a new division: Place the insertion point where you want to start the new division. Press ⌘-Enter. Usually, starting a new division starts a new page.
Topics
Next
Previous
Cancel

Online helps are plentiful.

Before you cheer too loudly, however, remember that the cursor movement commands were clearly added after the rest of the keyboard sequences were finalized. They aren't even discussed in the manual proper, but are explained in a separate folder instead. As a result, they require depressing up to *four* keys at once to move the cursor and *five* to use the keyboard to make a selection! This is simply poor design.

The mouse is wonderful and makes many editing jobs much faster.

This one failing of *Word* detracts little from what is basically an excellent product. Besides the tremendous number of functions, everything seems much faster than on the PC. *Word* in the IBM environment is "sluggish" on a PC or XT, but is totally satisfactory on the Mac. Screen updating is very quick; it is impossible to type faster than the system, and even saving and loading files is quite fast.

Some other features which don't appear on menus include the ability to move standard *MacPaint* pictures or charts produced with Microsoft *Chart* into a *Word* document just as with *MacWrite*. This is a tremendous improvement over *Word* on a PC, which has *no* graphics capability. Four simultaneous windows are available, compared to eight on the PC. Eight windows are really not necessary; use of more than two or three is rare. The windows are only horizontally split, but full use of the Macintosh window sizing makes this just as flexible, or more so, than the PC implementation. Windows can be dragged, snapped to full size and back, etc., very easily.

Printing documents is straightforward and similar to *MacWrite*, but *Word* is faster in high quality mode. Some enhancements allow margin adjustment and multiple copies during printing. A special font called Dover is supplied for use with daisywheel printers. It is available in 10, 12, 15 and proportional spacing pitch. It is not particularly attractive on the screen, but it is designed to provide a screen representation of the line breaks that will print on a daisywheel printer. When using this font, the blinking bar cursor is very close to the last letter typed—so much so that the letter is not correctly formed until the cursor is moved. This is somewhat distracting and is a characteristic of the Dover font, not *Word* itself.

The length of a *Word* document is not limited by memory size, because the program can "page" text onto or from disk if needed. While this obviously slows things down a bit compared to a completely memory-resident file, 128K Mac owners can now edit the long files previously available only to those lucky enough to own 512K Fat Macs. The program does run a bit faster and has to do less paging on a 512K machine, but it works perfectly well in 128K.

Summary

Word on the Macintosh is, in many ways, easier to use and more desirable than the version available for the IBM PC. The PC keyboard sequences are much better, but the visual performance of the Mac screen and the power of the Mac interface more than compensate.

Comparing Macintosh *Word* to *MacWrite* is simply not fair. Tremendous increases in functionality of *Word* are obtained with a relatively small increase in learning time and complexity. ■

CIRCLE **406** ON READER SERVICE CARD

Printer Enhancers

Give your dot matrix printer new personality and style/**C.J. Puotinen**

Everyone who buys a personal computer daydreams about the perfect printer. It never breaks down. It prints like lightning. It produces letter quality hard copy.

Unfortunately, the fastest letter quality printers cost more than many microcomputers, and their repair bills can be stunning. Dot matrix printers are often sturdier, less expensive, and much faster, but their output can be hard to read. Characters are boxy and half-formed, and the effect is often impersonal, mass produced, and printed-by-computer.

A growing number of inexpensive daisywheel printers compete for the low-priced letter quality printer market, but most are snail-slow, which makes the printing of rough drafts a truly tedious experience.

If only a speedy dot matrix printer could produce letter quality printout, too. Enter a new generation of printers equipped to do both—complete with higher price tags. (See article on 24-pin printers elsewhere in this issue.)

But new hardware is only one approach. The other is software— specifically, programs that change the output of a dot matrix printer.

Reviewed here are eight printer enhancement programs, each with its own personality and talents. Their prices range from $69.95 to $180, and they work with a variety of word processing programs and printers. All run on the IBM PC and compatible machines; two offer Apple versions, and another works with most CP/M systems. As the accompanying illustrations demonstrate, their results vary dramatically. Depending on what you need in the way of improved output, one may be ideal for your situation.

NicePrint

Of the programs described here, *NicePrint* is the easiest to learn and use. It isn't the most versatile program (it doesn't include a program for designing your own fonts, for example, nor does it offer proportional spacing), but for straightforward text printing, it works very well.

NicePrint was the first memory-resident program in this category. You load it by typing the command NICE before loading your regular word processing or spreadsheet program. When you are ready to print a file, you simply use the normal print commands of your word processing or spreadsheet program. With no further instructions from you, your text will emerge exactly as you arranged it in correspondence quality Roman type.

You can control *NicePrint* from the keyboard, if desired, just before printing begins or at any time during printing, to change the font or character size.

Embedded commands vary type style or pitch in the middle of a document and italicize words and phrases. For example, the code \4 begins italics in the type style and type size in effect, and \5 ends the italics. One additional step is necessary when you use embedded commands: you must press Ctrl+Alt+\ (the backslash key) after entering the print command and before printing begins. This tells the computer to translate the backslash commands into Escape sequences. Print sizes include pica (10-pitch), elite (12-pitch), and either pitch in double-high, double-wide, compressed type, or any combination thereof.

The most obvious advantage of the program is that you continue to use familiar format commands for margins, headings, line spacing, etc. I tested *NicePrint* with *WordStar*, Microsoft *Word*, *MultiMate*, and the *Idea Processor*. With each, it printed text files flawlessly, though it does not print the alternate (high-order bit) character sets of the IBM PC, which include foreign language symbols and graphics. According to the manufacturer, *NicePrint* also works with *PFS: Write*, *MultiPlan*, and a variety of other programs.

The IBM PC version is a close relative of the manufacturer's Super-MX Interface Card designed for the Apple, now called the NicePrint Card.

```
For comparison, this "before picture" paragraph was produced on an IBM Graphics Printer in its default mode.

  Samples shown here true to size were made on the same day using the same printer, ribbon, and paper.

  Printer enhancement programs improve the output dramatically. In fact, you might call this exercise the electronic equivalent of making a silk purse from a sow's ear.
```

Lettrix

Like many of its competitors, *Lettrix* has gone through major changes in the past year, and it deserves an award as the most improved program. Now memory-resident, it is far more versatile, offering more than a dozen separate fonts, each of which prints in italics, boldface, underlined, double-high, double-wide, pica, elite, condensed, proportionally spaced, monospaced, and with a justified or ragged right margin. In addition, its documentation has changed from several cryptic, loose pages to a nicely organized, easy to understand manual and an excellent interactive onscreen tutorial.

The embedded commands of *Lettrix* begin with the backslash, and upper- or lowercase letters mark the beginning and end of specific functions. For example, \P begins proportional spacing and

NICEPRINT is an "invisible" program that resides in RAM and improves the output of many programs. The printer can be controlled from keyboard or files. Here the default font is **Roman**, but embedded commands change to **Computer**, **Orator**, **Olde English**, **Script** or **Sans-Serif**. Any font can print in *italics*, **boldface**, ***or both***, and in any type size, from double-high Pica (shown at top) to condensed Elite and very wide.

\p ends it. Type faces are numbered according to the sequence in which you type them when you load the program. To create the sample printout accompanying this article, I typed the following load command: A > LX COURIER GOTHIC OLDELISH BROADWAY CYRILLIC GREEK. *Lettrix* then recognized \2 as the command to change to Gothic font, \3 as the Olde English command, and so on. Of the programs mentioned here, *Lettrix* is the only one that includes appropriate accent marks for its Greek font. It is also the only program that prints the complete IBM alternate character sets in every available type style.

Additional fonts include Orator, Western, Script, Engraved, OCR, ABC Block, Outline, and Science. *Lettrix* has recently improved its approach to scientific equations, but in truth, none of the programs mentioned here offers a simple, straightforward approach to complex equations. Users whose work involves statements as complicated as the Navier-Stokes equations should investigate programs designed specifically for such projects, all of which require graphics support.

You can modify any existing font or create new fonts. *Lettrix* is compatible with a variety of text editors and spreadsheet programs, but if you have 256K or less of RAM, you may encounter problems with programs that use most of the available memory. For example, I had no trouble using *Lettrix* with *WordStar* and Microsoft *Word*, but when I tried to load *MultiMate* version 3.22, the message "Insufficient System Memory" appeared.

Memory-resident Lettrix offers several fonts and support of the full IBM alternate character set, including ♥ ♦ ♣ ♠ ½ ¼ Ç ü é â å £ ¥ ñ and ¿. Courier is this type style, and this is Gothic, a sans-serif font. Olde English and Broadway offer variety. Fonts can be changed at any time and can be printed in various heights and sizes. Altogether there are 14 type styles, including Cyrillic and Greek. Every font prints boldface and *in italics*. Up to six fonts can be loaded.

Я умею читать по-русски.
εἰ πράττοι τοῦτο, καλῶς ἂν ἔχοι.

Fontastic

NicePrint and *Lettrix* are designed for the straightforward printing of text; *Fontastic* shines with special effects. Its fonts include a dozen unusual and large type styles that make effective and interesting titles, plus Hebrew, Russian, Punjabi, and Japanese. In the accompanying illustration, I used Roman, Calligraphy, Stick, Dash, Litebold, Special, Block, Cursive, Reverse, Elite, Script, Gothic, Hebrew, and Russian fonts, in that order.

The program makes it possible to design and print illustrations as detailed as electrical circuits and floor plans,

Print Speed
A Benchmark Test

Quality is only one part of the printer enhancement picture. Another is the effort required to use a program, and a third consideration is speed.

To compare the programs' printing speeds, I prepared a 500-word benchmark file using a 65-character line width, single line spacing, and a ragged right margin. All of the programs were used with a 256K IBM PC with dual disk drives and an IBM Graphics Printer. If a program offered a choice between proportional spacing and normal, I chose the latter. In every case I used Roman type—10-pitch if available, or whatever came closest.

Timing began as soon as the print command began to execute and included font-loading time where appropriate. Note that the words per minute rate is for comparison only; speeds are faster on most other printers. On any printer, a wide document will print faster than its narrow equivalent.

Program	Time*	Words per Minute
IBM Graphics Printer	0:52†	577 wpm
NicePrint	4:47	104 wpm
Lettrix	4:57	101 wpm
Fontastic	4:52	103 wpm
Type Faces	8:15	61 wpm
Fancy Font	18:05	28 wpm
PrintWorks	2:10	231 wpm
Tech/Print	(not applicable: no correspondence quality font)	
LePrint	6:51	73 wpm

*Minutes and seconds to print 500-word, 65-character-wide file
†(default font, normal printing speed)

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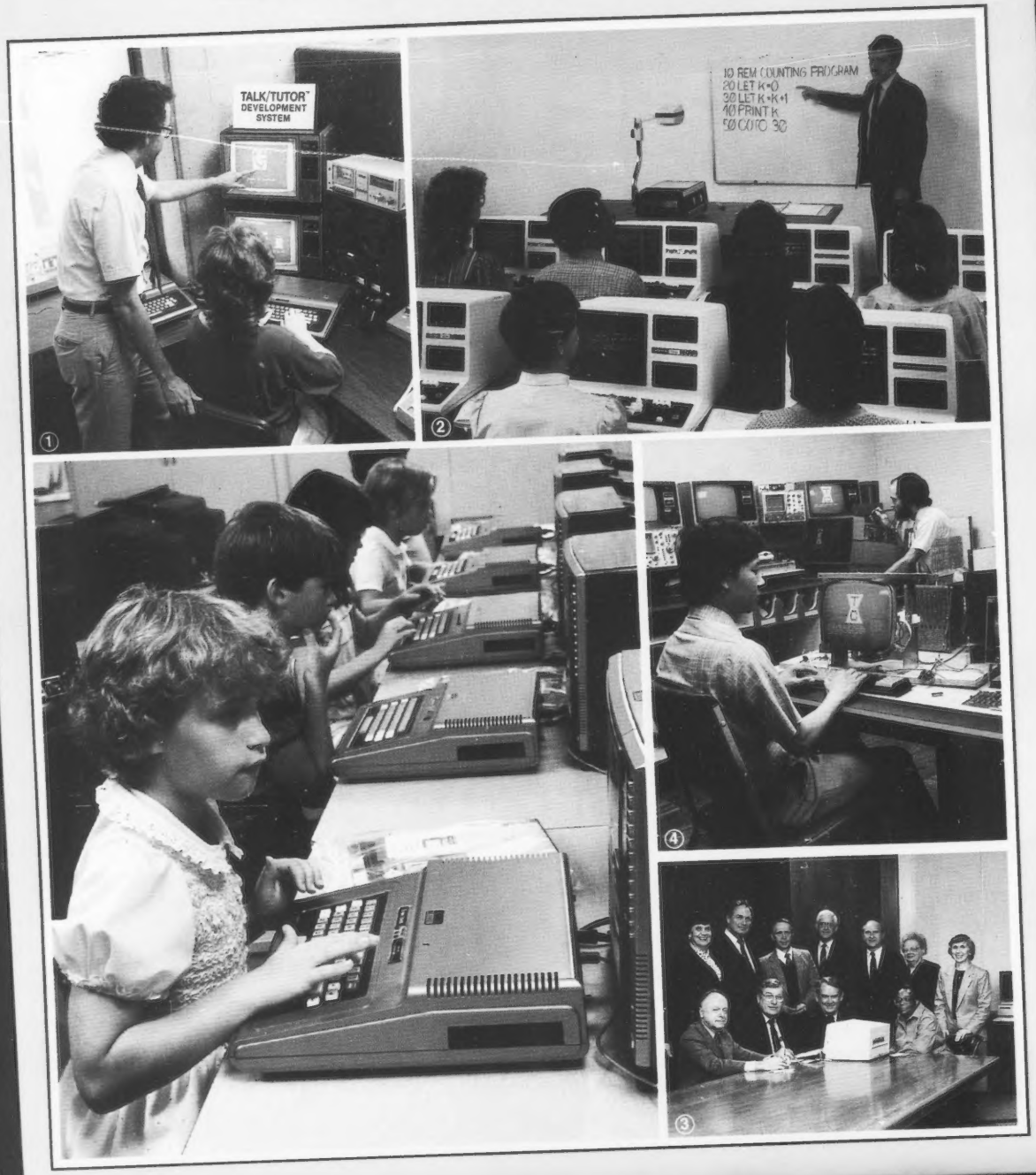

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National Conferences

In 1984, we joined with the University of Texas at Austin, College of Education, Continuing Education Program to sponsor a conference on computer use in education. The conference was a success, providing a forum to discuss applications, benefits and developments in educational computer use. A second conference in the spring of 1985 provided another opportunity for educators to keep abreast of educational computer technology.

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CIRCLE 133 ON READER SERVICE CARD

though not without some effort. It also includes a utility for modifying fonts and creating new ones. In addition, users of printers that accept down-loaded fonts or offer a mode-setting option have a new program called *FontSet*, which offers proportional printing, various printing modes, and down-loaded fonts.

What *Fontastic* doesn't offer is a selection of pleasing, easy to read, correspondence quality type styles that print 10 or 12 characters to the inch. The *Fontastic* manual is printed almost entirely in the "normal" font, which is nothing more than the default type style of your printer printed slightly darker, with an occasional phrase in italics for variety.

While *Fontastic* rejects control codes generated by word processing programs, it relies on its own embedded commands to load and change fonts within a document and create special effects. Control words resemble dot commands. Each begins with a colon and is followed by an abbreviation, and only one control word can appear on a line. Control characters are embedded in the text itself.

Not every printer responds to the embedded commands. For example, the manual notes that the C. Itoh printer does not print italics. Of the three methods for changing to italic type, only one works with the IBM Graphics Printer. None of the special features such as italics, subscripts, condensed type, or double-width works with any but the default or normal font on any printer. From a text-printing perspective, this is the most serious drawback of the program.

The *Fontastic* manual is reasonably well written, though an index would make it easier to use as would some reorganization. More important, its most attractive fonts are far too large for standard documents, and they can't be reduced. All fonts can be enlarged, though not always successfully. Last, the program's demonstration files are misleading, for they imply full compatibility with *WordStar*; in fact, some fonts require high-order bit characters, which *WordStar* (and several other programs) cannot produce. These complaints aside, *Fontastic* has a logical command structure and some interesting applications.

Type Faces

In its present version, *Type Faces* has a rather limited application: this program prints well designed characters in large sizes only. A serious disadvantage is its restriction of one font per line, which means that you can't change from regular to italic characters, for example, for just one or two words.

The fonts are attractive and pleasing for headlines, special announcements, slide captions, and other unusual projects, but they are of little use for typing straight text. The manufacturer suggests photoreducing the printout by 25 to 50% or more, a procedure that requires an extra step and equipment that few users have on hand.

On the positive side, *Type Faces* comes with the best manual for novice users, complete with cassette taped instructions, step-by-step descriptions of every procedure (both DOS and *Type Faces* commands), and an index.

To use *Type Faces*, you prepare both a program disk and a data disk. The data disk always goes in Drive B and contains, in addition to certain *Type Faces* files, the document file you want to print. This disk is kept busy because every file you want to print must be copied onto it, and as the disk fills up, you erase old files to make room.

Type Faces will print files generated by just about every word processing program. It responds to a wide variety of embedded commands—most of them one- or two-part dot commands.

Though the program claims 16 separate fonts, there are really six: Roman in five sizes, Roman italics in three, the Greek alphabet in three sizes, two styles of Script type, Italian Gothic, English Gothic, and a special font of small illustrations.

Fancy Font

The package includes a note about *Fancy Font* user groups. Why, I wondered, would anyone want to join a user group devoted to a printer enhancement program? Spend an afternoon trying to decipher this one and you'll know! Here is the most complicated, irritating, slow-printing program around—and it produces the most satisfying, proportionally spaced, exquisite hard copy. If your first priority is text that looks truly typeset, *Fancy Font* is worth the time and effort it demands.

To make a file print correctly, you must embed a few (or a few dozen, or a few hundred) *Fancy Font* commands in its text. Files can be generated by most word processing programs, but nearly every format condition (from headings and footings to top and bottom margins, right margin justification, page breaks, tab indents, and page length) must be defined with appropriate *Fancy Font* commands. Version 2.1, described here, is much easier to use than its predecessor because it offers a word wrap command; a user choosing a justified right margin is spared the frustration of defining the contents as well as the width of a line. In addition, the complete assortment of Epson fonts can be accessed using con-

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CIRCLE 102 ON READER SERVICE CARD

Fancy Font offers proportional spacing and versatility in its Roman, Sans Serif, and novelty fonts, such as:

Script, Olde English, Caligraphy, *Formal*, Chess and Twist. The type styles are available in many sizes and print in **bold face** *and italics*. Character sets include Greek and Hebrew:

αβγδεζηθικλμνξοπρστυφχψω

השורה החוזרת מתחיל בעברית

trol characters.

The *Fancy Font* embedded control codes are easy to use, but they require concentration. So does the print command. The print command for my sample printout, for example, was: A > Pfont b:ff +fo romn12 sans12 scrp20 olde20 twst14 cali24 chess18 romn10 romnb12 romni12 class12 hebr17 frml18 +lw 2.25i +sp 0i (RETURN).

Got that?

Because the printing is excruciatingly slow (*Fancy Font* makes twelve passes over each line), the draft mode, which gives a lightly printed preview of the final results, is a time saving convenience.

For those who want to design their own fonts, *Fancy Font* provides the Hershey Character Data Base and additional programs. In general, the provided fonts are pleasing and easy to use; my one complaint is the ridiculously wide hyphen (see the printed example). I used the font editor to reduce its width in "customized" Roman and Sans Serif files, but that is an exercise I don't look forward to repeating. Design-your-own-font options are not attractive to all.

Last, a note on foreign languages. The *Fancy Font* Classical Symbols font includes all the lowercase Greek alphabet characters but only those uppercase characters not already supplied by a corresponding Roman font, an arrangement more convenient for the programmers than the users of *Fancy Font*, and there are no Greek accent marks. When it comes to typing Hebrew, which reads from right to left, there is simply no comfortable way to proceed with any program that enters text from left to right.

Printworks

Printworks is a program built for speed, not glamour. It prints substantially faster than the other programs described here, but fonts print in pica, elite, double-wide, and condensed sizes only, and you can use only one font in one size per file. (There are exceptions to this rule, but they require expertise and support from the technical staff.) The program offers an assortment of type styles, but their small size limits their application. It is possible to generate a page of text using more than one typestyle, but it usually requires setting up a separate text file for each font and printing them consecutively. *The Printworks* sample accompanying this article consisted of 17 separate files.

One of the intriguing options of the program is its series of foreign language character sets. But these are standard Epson fonts; they work by redefining certain symbol keys as foreign characters. For example, the English font substitutes the English pound sign for the # symbol. The French, German, Danish, Swedish, Italian, and Spanish fonts replace other symbol keys with appropriate letters. The Japanese character set turned out to be nothing more than our familiar keyboard with the symbol for Japanese Yen replacing the backslash. These fonts print in the standard dot matrix type style only and are not compatible with the *Printworks* custom fonts, although individual characters can be transferred from one font to another.

SoftStyle, the company that makes *Printworks*, is especially proud of its pivot font, which prints letters and numbers sideways. By itself, the pivot font rotates characters individually 90 degrees, but the pivot print option rotates an entire document page or section of text, emulating the Funk Software *Sideways* program, condensing wide spreadsheets and similar projects.

The *Printworks* print menu lets you download certain fonts and settings so they remain in effect while you use your word processing program and its regular print commands. For downloaded settings to remain in effect, the printer must remain on-line and turned on.

PRINTWORKS has a large number of small fonts, all of which can print extra wide or in condensed mode, as you see here.

Pivot printing emulates the popular Sideways program. Option Q Pivot Printing) Option P Pivot the text to print the right edge of the page as a single unit and condensed.

Advanced Options menu activates this mode: your file's contents

FONTS INCLUDE ORATION, COMPUTER, Script, Chunky, STENCIL, Stripe, MACHO, Broadway, Elite, SHADOW, BLOCKY

αβγδεζηθικλμνξοπστφχψω

Printworks is entirely menu driven and very easy to use. As the speed comparison chart shows, it is also very fast.

Tech/Print

Not every program can generate the graphics characters and foreign language symbols in the IBM alternate character sets. *WordStar* is the most widely used program in this category. This means that *WordStar* users can't produce scientific equations, graphic designs, and other unusual symbols with a matrix printer.

Tech/Print was designed to correct this deficiency. Using the standard keyboard, *WordStar* users can enter familiar commands to change from the standard font to a special math font, italics, or either of two graphics fonts.

At this time, the *WordStar* boldface and doublestrike commands work only with the default font; they are not supported by italic type, either of the graphics fonts, or the math font.

Tech/Print is easy to use, especially for those already familiar with *WordStar*. Its manual is well designed, showing the letter key equivalent of every alternative font character, and the disk supplies an interesting sample file which makes extensive use of the Math font. In fact, I borrowed two equations from this file for use in the illustration accompanying this article, then drew a

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The throne awaits, but not forever. The gong is struck, it tolls…

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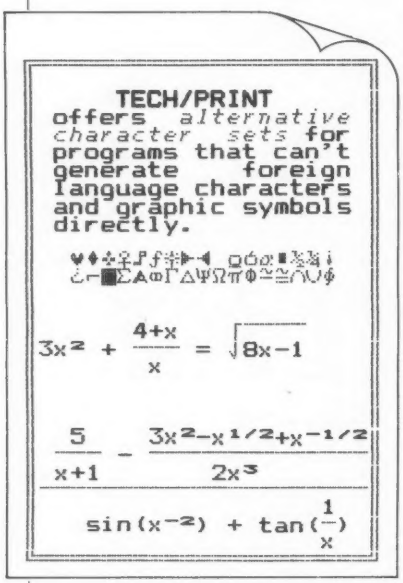
CIRCLE 101 ON READER SERVICE CARD


TECH/PRINT
offers alternative character sets for programs that can't generate foreign language characters and graphic symbols directly.

border around the print sample with the *Tech/Print* IBMGRAF1 font.

Despite its limitations, *Tech/Print* greatly expands the capabilities of certain word processing programs, filling the needs of a specialized audience.

LePrint

LePrint is another program designed for use with *WordStar*, and while it doesn't generate equations, its effects are dramatic in another way. *LePrint* offers typesetting fonts and fonts that mimic electric typewriters, all of which print in microscopically adjusted sizes between 1/12" and 10". In fact, *LePrint* is the only program described here that lets you define font size so precisely; it accepts measurement commands in centimeters, didot points, em-quads, en-quads, inches, millimeters, picas, and points. While some characters become less attractive as they grow larger, the letters I generated with *LePrint* in the 1 to 2" range were very well executed.

The manual was printed with *LePrint* on a Toshiba P1350 printer, and it is very attractive. But leafing through it, I wondered why it wasn't printed with a justified right margin, which would make it look more professionally typeset. After spending a day with the program and the accompanying illustration, I understood why. At the beginning of every new paragraph and whenever you change fonts within a line, *LePrint* redefines the right margin. *LePrint* doesn't let you enter a specific line width to be maintained throughout the document; instead, it defines the line width by the contents of the line. If there

LePrint is a specialized program that prints WordStar files. Its claim to versatility comes from eight type styles (this is Times, a proportional font), which print in literally any size between 1/6 inch and 10 inches high. *This is Times Italic.* In addition to Times, proportional fonts include:

Clarendon
Helvetica
Gothic (Sans-Serif), and
Park Avenue

Last, three typewriter fonts give text a typed appearance: Courier, Prestige and Pica styles. These are not proportional fonts.

Printer Enhancement Software

Name, Price, Manufacturer:	System:	Printers:
NicePrint; $95 Spies Laboratories P.O. Box 336 Lawndale, CA 90260 (213) 538-8166	IBM PC, PCjr (PC-DOS); requires 14K or 28K of RAM and is memory-resident; card version available for Apple computers	IBM Graphics, Matrix with Graftrax; Epson FX, RX series, MX-80 with Graftrax, MX-100 with Graftrax-Plus; Gemini 10, 10X, 15, 15X; Okidata 92, 93 with IBM Plug & Play
CIRCLE **407** ON READER SERVICE CARD		
Lettrix; $98.50 Hammerlab Corp. 7301 Yale Station New Haven, CT 06520 (800) 351-4500 (203) 776-5699	256K IBM PC (PC-DOS or MS-DOS), dual disk drives	IBM Graphics, Matrix with Graphics option; Epson MX series with Graftrax Plus, FX, RX series; any Star Micronics; C. Itoh 8510 BPI, EP; Inforunner Riteman; any Okidata with Plug & Play; Hewlett-Packard Thinkjet
CIRCLE **408** ON READER SERVICE CARD		
Fontastic; $95 IHS Systems 4718 Meridian Ave. Suite 211 San Jose, CA 95118 (408) 265-5503	192K IBM PC (MS-DOS)	Epson MX, RX, FX series; IBM Graphics, Matrix; C. Itoh 8510A, 8510BPI; Gemini 10X, 15X; Okidata 84 (with APA option), 92, 93 (with Plug & Play option); Texas Instruments 855; Toshiba 1340, 1350, 1351; Fujitsu DPL24, DPMG9; and 21 additional Epson-compatible printers
CIRCLE **409** ON READER SERVICE CARD		
Type Faces; $95 Alpha Software Corp. 30 B St. Burlington, MA 01803 (800) 451-1018 (617) 229-2924	64K IBM PC (PC-DOS or MS-DOS), dual disk drives; 64K Apple II with dual disk drives	IBM Graphics; Epson MX, FX, RX series; IDS; NEC 8023; ProWriter; C. Itoh 8510; Okidata 82, 83, 84, 92, 93; Datasouth 180; Apple version works with Epson MX and FX, IDS, Apple Silentype
CIRCLE **410** ON READER SERVICE CARD		
Fancy Font; $180 SoftCraft, Inc. 222 State St. # 400 Madison, WI 53703 (800) 351-0500 (608) 257-3300	128K IBM PC (PC-DOS or MS-DOS); 64K CP/M systems; Apple II; dual disk drives	Epson MX series with Graftrax, FX, RX series; IBM Graphics; Star Gemini 10X, 15X, Radix, Delta; NEC 8023; C. Itoh ProWriter (requires IBM conversion program with IBM PC)
CIRCLE **411** ON READER SERVICE CARD		
Printworks; $69.95 SoftStyle, Inc. 7192 Kalanianaole Hwy. #205 Honolulu, HI 96825 (800) 367-5600 (808) 396-6368	128K IBM PC (PC-DOS or MS-DOS)	Epson MX with Graftrax Plus, RX, FX, JX, LQ series; IBM Graphics; C. Itoh ProWriter 1550, 7500, 8510 E or BPI series; Centronics Horizon, Quietwriter; Inforunner Riteman Plus, Blue Plus, II 15; NEC Pinwriter P2-3, P3-3, CP2-3, CP3-3; Okidata ML 84 Step 2, ML 92, 93 (with Plug & Play), Pacemark 2350 and 2410; Star Micronics Gemini 10X, 15X, Radix 10, 15, and Delta 10, 15
CIRCLE **412** ON READER SERVICE CARD		
Tech/Print; $69.95 Goldstein Software 2 Redgate Ct. Silver Spring, MD 20904 (301) 384-5565	96K IBM PC (PC-DOS)	Epson MX, RX, FX series; IBM Graphics, Color; Okidata 92, 93, 84 with Plug & Play; Texas Instruments 850, 855; Gemini Star; C. Itoh Starwriter, ProWriter; Diablo 630 ECS; Hewlett-Packard Laserjet; Epson LQ 1580
CIRCLE **413** ON READER SERVICE CARD		
LePrint; $149.95 Writing Consultants 11 Creekbend Dr. Fairport, NY 14450 (800) 828-6293 (716) 377-0130	128K IBM PC	Apple DMP, Imagewriter; C. Itoh 8510 ProWriter; Epson FX, MX, RX series; IBM Graphics; Okidata 92, 93; Panasonic KX series; Tandy DMP-2100; Toshiba P1340, P1350, P1351
CIRCLE **414** ON READER SERVICE CARD		

are no unnecessary spaces in the line, *LePrint* assumes the paragraph does not have a justified right margin. Regardless of the character size specified, *LePrint* defines the width of the paragraph in inches by the width of the first line, and it follows the formula 10 characters = 1 inch. Last, imbedded *WordStar* commands count as characters; the program includes these non-printing codes in its definition of the first line of a paragraph.

I wanted the illustration to measure 2.25" wide by 3" deep. The only way to approach these dimensions was to create a first line that measured 23 characters wide, these characters including at least one unnecessary blank space and any embedded command codes. *LePrint* worked fine, setting the line width at 2.3" and setting a justified right margin. The printed text was arranged very differently from the screen text, but that was fine—until *LePrint* encountered the command for changing from Times Roman to Times Italic. At that point, it redefined the right margin, and that is why the illustration shows a less-than-straight edge. No matter how I rearranged the affected lines, the program revised the right margin. A user who wants professional looking results will find this a frustrating problem.

But for projects that use a ragged right margin and correspondence that should look typed rather than computerized, *LePrint* does an excellent job.

In fairness to this interesting and potentially powerful program, I should point out that my copy is a Beta test version and that the final edition promises improved performance.

A Final Word

Programs change rapidly in the printer enhancement field, so write to the manufacturers for font samples, specifications, and the latest improvements. Define your printer-related needs carefully so you can judge the relative importance of price, speed, versatility, and quality.

When you buy a printer enhancement program, make your backup copy and then, before you do anything else, display and print the disk directory. In most of the programs described here, this is the only way to determine the names of the available fonts. The printed screen directory can be an important reference.

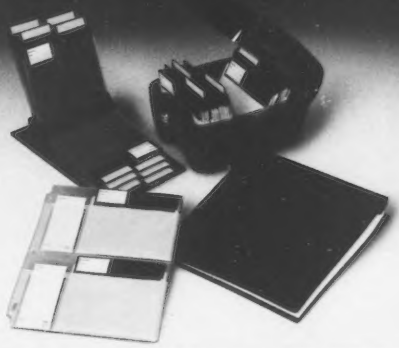
Next, print whatever sample or demonstration files come with the program. These files will show very graphically what your printer is able to produce. Use your word processing program to inspect the embedded commands that produce the hard copy you have just printed.

Make your own demonstration files, one for each available font. My standard test file shows the font name, then the entire keyboard, upper- and lowercase, one line at a time. Such a printout may be essential if you are using a foreign alphabet or other special font. In some cases, it is necessary to prepare a file using two fonts, one showing the screen symbol in a "normal" type style, the other its printed equivalent.

Then experiment. If experience doesn't answer your questions, the manufacturer will. I found all of the technical support staffs helpful, friendly, and informative.

And don't forget to write. We look forward to seeing your correspondence quality correspondence. ■

Data worth keeping deserves a Data Defender.



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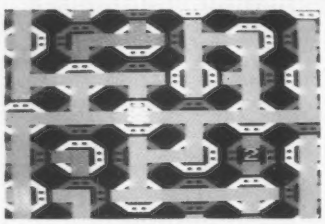
CIRCLE 149 ON READER SERVICE CARD

Gamut of Games

Action for all/**Russ Lockwood**

Much of the entertainment software we receive each month fails to entertain us. Often, the new packages are inadequate rehashes of existing software or once-popular arcade games. However, every once in a while, new offerings catch our eye and call us to man the joysticks. These five programs succeeded in grabbing our attention.



Zenji

GRAPHICS (−) (+)
PLAYABILITY (−) (+)
CHALLENGE (−) (+)
ADDICTIVENESS (−) (+)
EASE OF LEARNING (−) (+)

System and Price: C64 disk, $34.95; Atari cartridge, $24.95

Summary: Rather addictive

Manufacturer:
Activision
P.O. Box 7287
Mountain View, CA
94039
(415) 960-0410

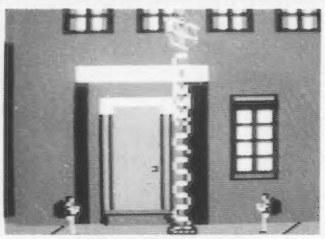
CIRCLE **415** ON READER SERVICE CARD

Activision touts *Zenji* as an exercise in Eastern philosophy, with mumbo jumbo about karma and yin and yang. Well, we do not buy any of that, but we do buy the premise of the game and can attest to its excitement, addictive qualities, and entertainment value.

The screen displays what looks like a maze of disconnected plumbing. Your goal is to connect all the pipes to a central point before time runs out or one of the evil spirits touches or shoots you. Traversing special sections of pipe earns you bonus points.

The maze grows larger with each completed screen. The graphics are plain and functional, and an enchanting tune plays in the background.

Activision scores a big hit with *Zenji,* an original, exciting, and addictive arcade game.



Ghostbusters

GRAPHICS (−) (+)
PLAYABILITY (−) (+)
CHALLENGE (−) (+)
ADDICTIVENESS (−) (+)
EASE OF LEARNING (−) (+)

System and Price: C64 disk, $34.95; Apple disk, $39.95; Atari cartridge, $29.95

Summary: So-so game has some high points

Manufacturer:
Activision
P.O. Box 7287
Mountain View, CA
94039
(415) 960-0410

We think the movie is fabulous. It is witty, funny, creative, and embodies all the other good things that make movies entertaining.

You own a Ghostbusters franchise and start with $10,000 in seed money to buy such necessary items as Ghost traps, bait, a PK Energy Detector, and a Portable Laser Confinement System. You drive a specially equipped car around the city looking for ghosts. You try to trap them and then go on to the next. Each ghost is worth money. To win, you must earn more than $10,000 and sneak two Ghostbuster employees into the Temple of Zuul.

So far, so good. The theory of the game follows the movie. In practice, the driving and trapping aspects of the game wear a little thin. This is not to say the game is easy; in fact, it is just the opposite. *Ghostbusters* is so tough, it borders on frustrating. Fortunately, practice improves your score.

The game features the catchy theme song and also screams a demoniacal "Ghostbusters" when you nab a ghost or "He slimed me" when a ghost nabs you.

We wish we could be more positive. In its present incarnation, *Ghostbusters* is an ordinary game adapted from an extraordinary movie.

The Ancient Art of War

GRAPHICS (−) (+)
PLAYABILITY (−) (+)
CHALLENGE (−) (+)
ADDICTIVENESS (−) (+)
EASE OF LEARNING (−) (+)

System and Price: 128K IBM PC with graphics board, $44.95

Summary: Excellent abstract war game

Manufacturer:
Broderbund
17 Paul Dr.
San Rafael, CA 94903
(415) 479-1170

CIRCLE **417** ON READER SERVICE CARD

Of all the recent Broderbund releases, *The Ancient Art of War* is by far the best. The game takes its title in part from the book *The Art of War* written in 400 BC by Sun Tzu, a Chinese philosopher turned strategist. The book outlines principles of planning and strategy needed to defeat the enemy. The game allows you to put these techniques to work.

The game is a "generic" wargame with 11 campaigns that span the ages, from Wu versus Ch'u (China 400 BC) to War in the Mountains (Vietnam 1970). It has three types of soldiers—Barbarians, Archers, and Knights—and like the rock-scissors-paper game, each type fights better against a certain other type.

However, many variables must be considered, such as the condition and number of troops facing each other and the different battle formations they are in. The computer keeps track of the variables, which can be called up at any time.

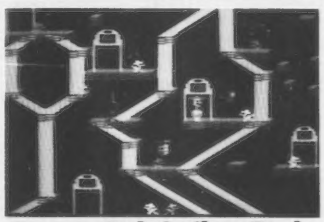
The screen shows a portion of the strategic map. You maneuver your pla-

toons using a joystick-controlled cursor and your troops require time to march from one place to another. Since this is a real-time game, the computer-controlled troops are also moving. When one of your platoons touches an enemy unit, they battle. Here you face two choices: let them slug it out without your expertise, or "zoom" into the tactical mode and command your troops personally.

You are allowed limited tactical control of a battle. You decide when the archers loose arrows, the knights swing swords, and the barbarians attack with kung fu kicks. At the conclusion of a battle—and there will be several during a campaign—the victorious troops raise their arms in a salute.

In addition, *The Ancient Art of War* contains a game generator, so you can create your own campaigns, complete with different types of terrain, troop strengths, and starting positions.

The Ancient Art of War combines good graphics, tactical and strategic dilemmas, and simplicity in a fine war game. We give this a five-star rating.



Bounty Bob Strikes Back

GRAPHICS (−) (+)
PLAYABILITY (−) (+)
CHALLENGE (−) (+)
ADDICTIVENESS (−) (+)
EASE OF LEARNING (−) (+)

System and Price: C64 disk, $39.95; Atari cartridge, $49.95

Summary: Buy this game

Manufacturer:
Big Five Software
P.O. Box 9078-185
Van Nuys, CA 91403
(818) 782-6861

CIRCLE **418** ON READER SERVICE CARD

If you have played *Miner 2049er*, you have already experienced the excitement and action of a Bounty Bob game. Well, Bob is back with 25 of the trickiest screens this side of the Mississippi.

This climbing and jumping game requires split-second timing and nerves of steel to cement the blocks in place, grab the various treasures, and vanquish the denizens of the mine. Slides, steps, teleporters, grain elevators, and other terrain provide enough challenge for veteran joystick jockeys, yet the learning curve is gradual and satisfying.

The game can be customized with varying difficulty levels, number of lives, and other options like pause and secret messages. The top ten scores are saved, although they vanish when the power is turned off.

In short, this is a first class arcade game. With 25 screens and 40K of memory, it packs a lot into a single cartridge. It is exciting, challenging, and addictive. Buy this game.

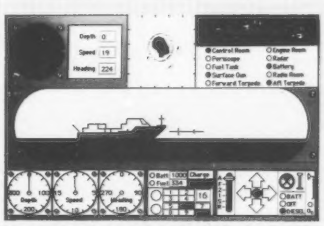
Gato, a real-time World War II submarine simulation from Spectrum Holobyte, plunges you beneath the waves of the Pacific in search of Japanese ships. As you patrol the sea lanes, you try to locate and stalk a convoy, close in to torpedo range, sink the ships, and escape before the escort destroyers zero in with their deadly depth charges and send you to Davy Jones's locker.

Gato takes its name from the class of diesel-powered submarines that formed the mainstay of the U.S. submarine fleet during WWII. The disk holds all sorts of interesting historical information on Gato-class subs.

Obviously, sailing a submarine solo on a computer is a little easier than doing it in real life—especially under wartime conditions. Yet how do you capture the feel of submarine operations?

In the case of *Gato*, designers Ed Dawson and Paul Arlton tapped the knowledge of retired Navy Captain Bill Graves. According to Spectrum Holobyte, veteran submariners agree *Gato* is an accurate simulation of submarine operation. The historical nits to pick are the inclusion of surface radar, use of only four instead of six forward torpedo tubes and zero instead of four aft tubes. Note that the Macintosh version corrects these omissions.

My experience on a submarine is limited to watching reruns of "Voyage to the Bottom of the Sea." However, as a game, *Gato* is to submarines as Microsoft *Flight Simulator* is to airplanes.



Gato

GRAPHICS (−) (+)
PLAYABILITY (−) (+)
CHALLENGE (−) (+)
ADDICTIVENESS (−) (+)
EASE OF LEARNING (−) (+)

System and Price: 128K IBM PC with graphics board, Apple II, Macintosh; $39.95

Summary: Excellent submarine simulator

Manufacturer:
Spectrum Holobyte
1050 Walnut
Boulder, CO 80302
(303) 443-0191

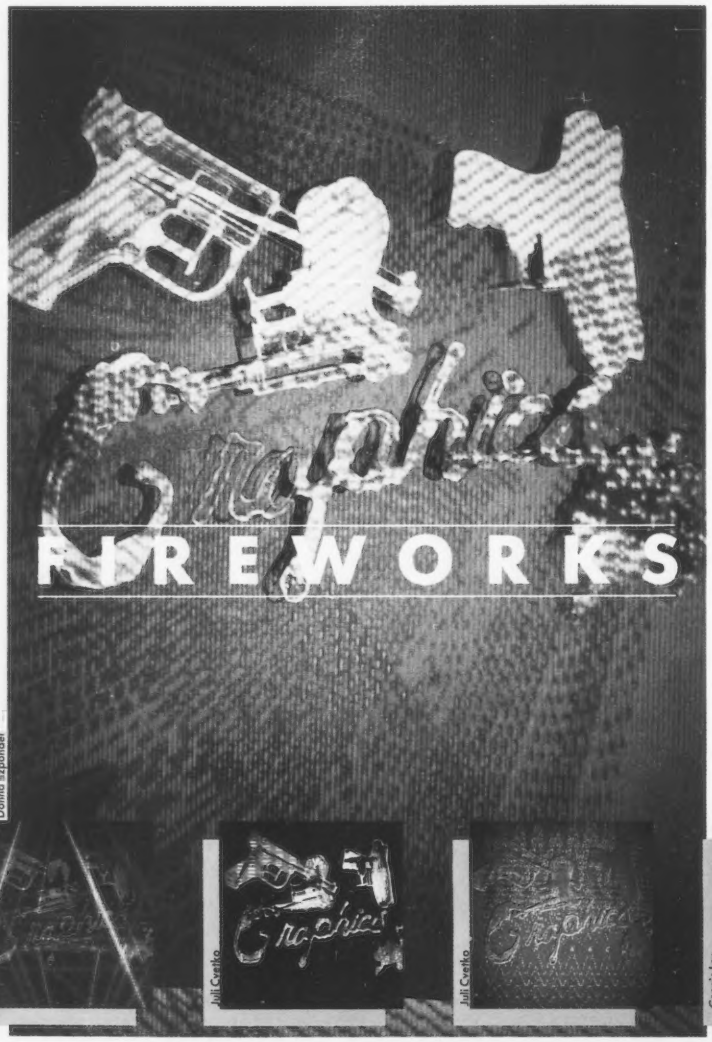
CIRCLE **419** ON READER SERVICE CARD

The manual is informative and a must read to truly understand how to operate the game. *Gato* has 10 levels of difficulty and includes daytime and nighttime play. Above level 7, messages from COMPACSUB (Commander Submarine Force Pacific Fleet) are beeped in Morse code. Various screens give you damage reports, radar findings, view from the bridge or periscope, and patrol area. The program saves your score (the Captain's Log) to disk.

Normally, the sub runs on diesel engines. However, when you dive below 20 feet, you must switch to electric power. The program tracks the charge left in the batteries as well as the breathable oxygen remaining.

The theory behind sinking ships is easy: line them up and fire a little ahead of them. However, doing so proves to be difficult. Fortunately, practice makes perfect, or at least good enough to sink a ship or two. I have to admit experiencing quite a bloodthirsty thrill when I sank my first Japanese cargo ship. This thrill carried over into successive games and is testimony to the ability of the simulation to involve you. Once you master the art and science of sinking a ship, you are ready to advance to tougher levels.

Gato is a terrific submarine simulation and should appeal to the same users who have become addicted to *Flight Simulator*. It is historical, involving, and incredibly versatile. If you yearn to lurk beneath the waves, play a deadly game of hide and seek, and experience the closest thing to undersea warfare next to submarine duty, take a close look at *Gato*. ■



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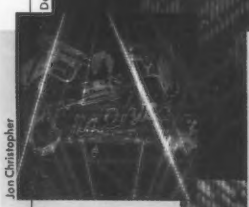
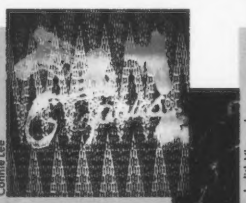


Jon Christopher

Juli Cvetko

Juli Cvetko



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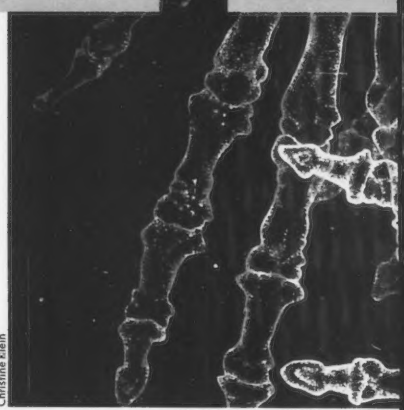
Judith Vinyard

Craig Johnson

Liz Waters



Christine Klein

Using PC graphics and simple darkroom techniques to create a gallery of images/ **Craig A. Johnson**

We had shared three months of excitement and frustration, and finally, it was clear what we had produced.

It had been a two-year project for me, and at the end of the first semester of teaching computer graphics at Southern Illinois University, I asked students to react openly in an exam essay.

"I definitely have been more stimulated with ideas than in any other class I've ever taken."

"You have unlocked and thrust us into a spinning world of new art. I feel a limitless power to create any design . . . I have so many ideas . . . I can't find the words to express the joy and exhilaration in my head."

Though this is typical of their reactions, these students had *not* spent the semester in command of any of the high-end marvels; they had not tapped the

power of a Bosch, Aurora, or Vax system. They were computer neophytes, from sophomore level up, and the spinning world of new art had been created with a single IBM PC, a graphics board, a camera, and some extremely entertaining and remarkably potent graphics programs.

A Matter of Timing

As the system was put together in pre-Mindset, pre-Artronics early 1983, when paint packages had not yet developed to the level of a *Lumena*, we had to find a new approach. We knew we wanted to exploit the PC and its ability to generate sets of lines quickly, with the user controlling color, linestyle, angle, etc. as the sets were built. I also wanted to continue working with moiré patterns (see *Creative Computing*, cover, Vol. 1, no. 6, 1975). These two elements were to form the basis of a new visual style.

The initial course design had to address several problems, not the least of which was a very limited budget.

First, we wanted to improve the resolution of the PC. (Tecmar maximum resolution is 640 x 400, with four colors—not bad, but we had to have more.)

To avoid alienating potential graphics users, we wanted to find a way to integrate existing skills in drawing, photography, and type rather than wipe out these hard-won abilities with an impersonal keyboard or digitizing pad.

Above all, we wanted a recognizable style to develop; a fresh graphics *look* must be completely accessible.

Finally, we wanted to concentrate on exploiting the *nature* of the computer, to have it do what it does best, rather than to force it into a role it simply could not fill. My programmer wife and I then set out to develop the software.

Christine Klein

The Process

The approach that evolved uses what we call "Moravian" programs (from moiré) to generate textures and patterns that can be merged with other standard graphics elements, using equipment likely to be on hand in an ad agency or studio.

The Moravian patterns are built by using function key editing and overlaying sweeps of linear tone. When the design is complete, the program is stopped and photographed on a Lang camera.

A pre-existing photo, drawing, or piece of type is put on 8" x 10" high-contrast black and white Kodalith film. Using relatively simple darkroom techniques, both a positive and a negative version are created. Most of the students were photographic novices, but all caught on quickly with minimum training.

To merge the computer images with the photo, drawing, or type, the Moravian slides are first loaded onto a rear-projection slide unit (a Kodak Ektagraphic or Singer Caramate). Then the positive image Kodalith is fixed to the screen, and a Moravian design is selected to project through the Kodalith, exposing on color slide film. This creates a positive black image on the colored computer background. Color can now be introduced to the areas masked by the black image on the film positive in the first exposure. To do this, the negative is switched with the positive Kodalith image, but kept carefully in the same position as the positive. The negative Kodalith image is registered using pins, a new computer design is selected, and a second exposure is made, double-expos-

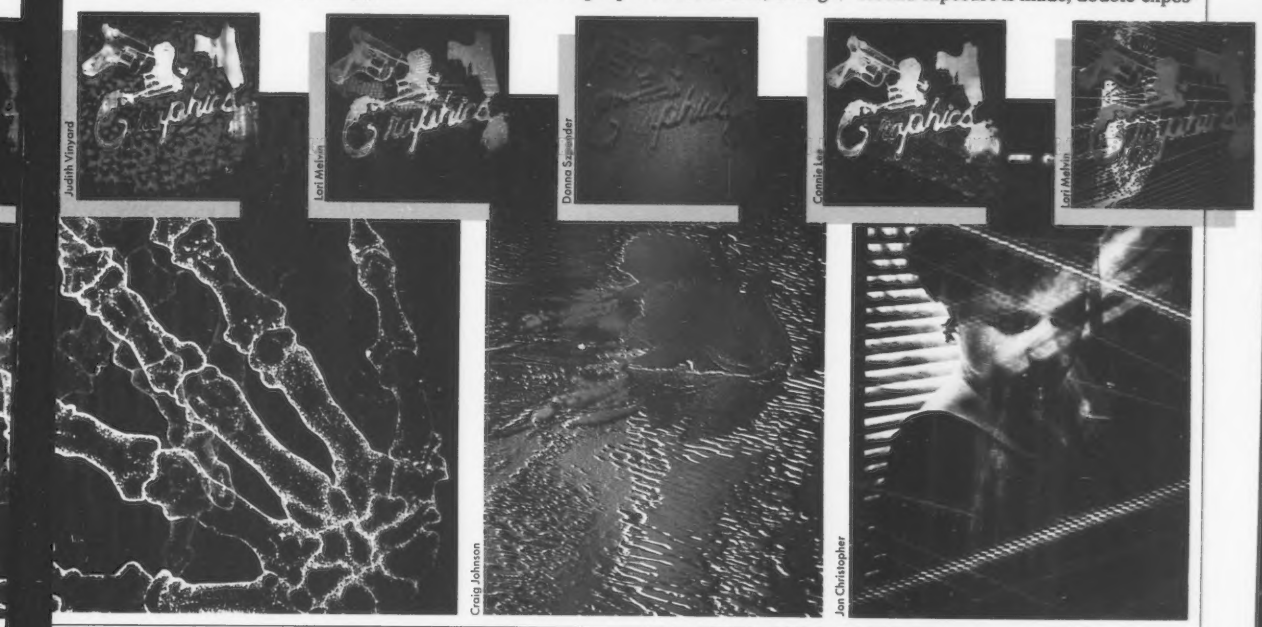


Figure 1.

In the Darkroom

The title illustrations for this article are examples of the countless variations which can be made from a few graphic elements using the "Moravian" imaging approach. One black and white photograph was submitted to the class. High contrast 8" x 10" film copies (Kodaliths) are made in both positive and negative form in the darkroom (Figures 1 and 2). Computer generated patterns (such as Figure 3) are projected through these and the combined result is captured on slide film with a 35mm camera.

In addition to double exposures using the two Kodaliths, masking of specific areas to expose even more patterns can build entirely new images.

To make masks (such as Figures 4 and 5), the Kodalith image is outlined on tracing paper, then placed on black construction paper and cut out with an X-Acto knife. These pieces are then cemented to acetate sheets for pin-registration punching.

Exposures can be made darker or lighter, filters used to soften patterns, and focus controlled to smooth color.

Since Kodaliths and masks are punched together (a standard three or two-hole punch is used) for pin registration, it is easy to re-position images and select completely different Moravian patterns and colors to obtain any number of different visual effects.

Figure 2.

Figure 3.

Figure 4.

Figure 5.

ing the image. The process can be repeated indefinitely, selecting different color and pattern combinations for each, resulting in a vibrant, colorful new style.

There are several clear advantages to the approach. The most obvious is the use of standard photographic equipment instead of more expensive digitizing hardware.

Results

By unfocusing and softening one or more of the exposures, very smooth, hires airbrush effects that are normally possible using only very expensive equipment can be achieved.

By using images produced with traditional techniques, artists retain familiar craft and feel, yet gain a new tool with which to infuse brilliant electronic color and design.

Moreover, the distinctive energy-field appearance of the patterns produces a recognizable style, while allowing a wide latitude for expression.

Later, we added a MicroControl Systems three-dimensional digitizer, the Space Tablet. Then we not only digitized actual objects, but also built 3-D patterns that could be rotated, scaled, put in perspective, and double-exposed with other elements.

Students found out quickly that access to a multitude of computer-generated slides presented dozens of possible solutions to a given graphic problem. An evening's work with various elements could result in a 20-solution client presentation. And it was fun!

The range of material produced in the first two-hour course attests to the agility of this approach. Thus far, class members have produced several two-color brochures, a fine art Purchase Award, a poster, a yearbook cover and eight full-color yearbook pages, silk-screen Moravian art and decorated ceramics, a slide show for an Advertising Club competition, and a full gallery show.

Craig Johnson

Even at the PC level, the computer is a powerful addition to any agency or studio interested in speed and production power in a fresh contemporary format. With a minimum investment in new equipment and standard design tools, the vibrancy of electronic imaging can be added to the full range printed artistic output.

The current state of computer graphics allows—even begs for—creative people to invent, create hybrids, and push current capabilities. Computers are recognized as powerful extensions to personal creativity, and will continue to help artists explore new visual worlds. It certainly is not necessary to be an IBM Fellow or work with fractals at Lucasfilm to explore these worlds. The beauty of the fractal's simpler cousin, the moiré, is available to all.

The School of Communications and Fine Arts at SIU has recently added a Mindset/Lumena system with a video camera and frame grabber, several IBM PCs with paint systems, and an upgraded version of the Space Tablet. Material produced with this equipment and software can be merged with the distinctive Moravian patterns. We are confident that it will continue to evolve and offer visual and creative stimulation. ■

Creative Computing wishes to thank the members of Southern Illinois University's Computer Graphics class and their teacher, Craig Johnson, who is now Director of the Computer Graphics Center at Bucks County Community College, PA.

SPECIAL REPORT

Digital Image Processors

Give your computer the gift of sight/**Owen Linzmayer**

A picture is worth a thousand words. At least I'm told that's how it was before inflation hit. Regardless, no one can dispute that the pictorial display of information is often invaluable. Until recently, however, the technology to display and process pictures on computers was available only to NASA and other high priority scientific pursuits. Now there is a new crop of peripherals on the market that can turn your home computer into a *digital image processor* capable of taking snapshots of your friends or adding graffiti to still frames from an MTV video. Digital image processing involves capturing and manipulating computerized photographs.

Typically sold by third-party manufacturers as peripherals, digitizers are hardware devices that allow you to take the output of any standard video component and turn it into a graphics display. Most digitizers come with software that helps you capture a clear picture and then modify, enhance, merge, or manipulate it. Text can be superimposed onto digitized photographs, or you can put a bowler hat on the image of President Reagan delivering the State of the Union address. The possibilities are truly unlimited. Much could be written, and it has, about the many productive uses of digital image processors, but this is a tutorial on how computers have come to see the world as we do: visually.

In The Beginning

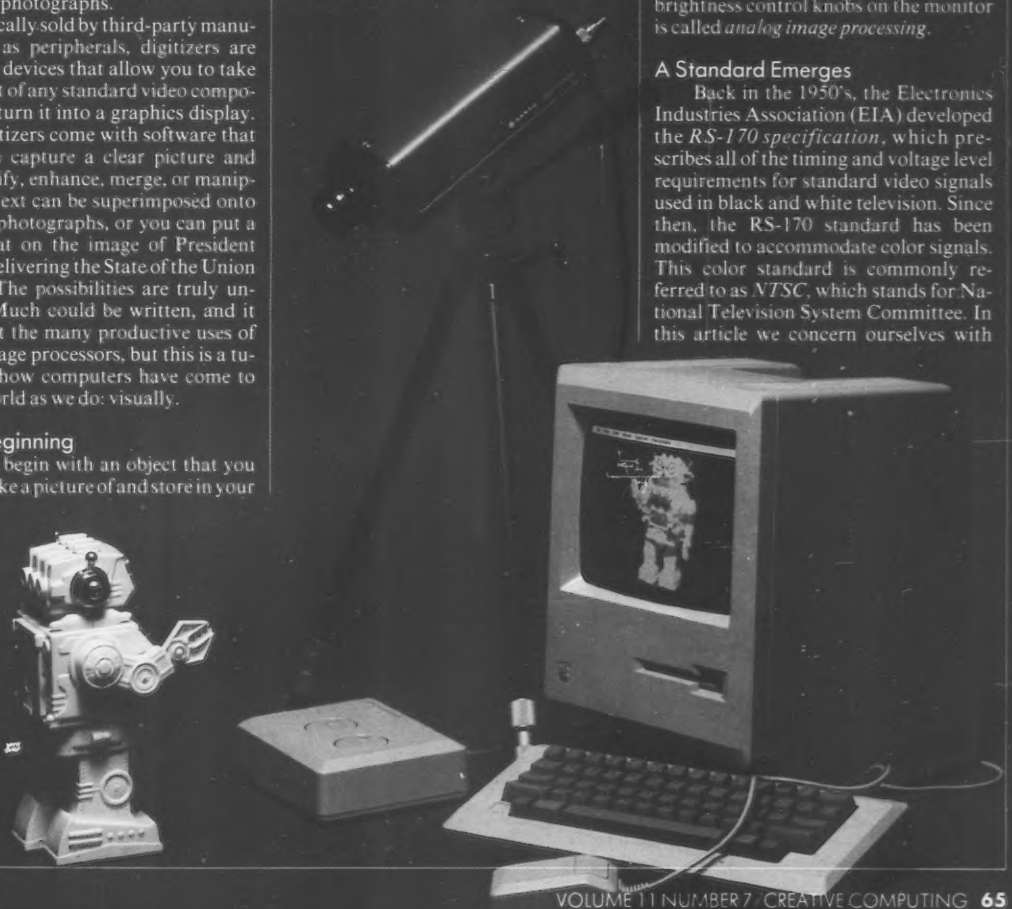
Let's begin with an object that you want to take a picture of and store in your computer. You place the object on your desk and focus the video camera on the object. Although in this example we are using a video camera, most of the digitizers available can be connected to any device, such as a laserdisc player or video cassette recorder, that outputs standard video format (more on this later). It is a good idea to split the signal coming out of the camera so that you can view the original image on a monitor while the computer digitizes it (see Figure 1 for example set-up).

Light is reflected by the object, and the electromagnetic lightwaves travel to an image sensing device within the camera. This device translates the brightness of the light at a given location on its surface into an electrical voltage. Synchronization pulses are added to the signal to allow the receiving device to know where the sequence is in the frame data.

The camera rapidly makes hundreds of thousands of such translations every second to generate a complete video picture. At this point the original image of the object and its surroundings has undergone optical processing. The light intensity information is then sent from the camera to the closed-circuit monitor. Direct manipulation of the video signal by adjusting the contrast and brightness control knobs on the monitor is called *analog image processing*.

A Standard Emerges

Back in the 1950's, the Electronics Industries Association (EIA) developed the *RS-170 specification*, which prescribes all of the timing and voltage level requirements for standard video signals used in black and white television. Since then, the RS-170 standard has been modified to accommodate color signals. This color standard is commonly referred to as *NTSC*, which stands for National Television System Committee. In this article we concern ourselves with



Photography by Jeff MacWright.

black and white digitizing only, but color digitizers work similarly. In fact, the Photocaster from Commsoft can actually do color digitization by scanning an image three times using red, green, and blue filters. The accompanying software then mixes the individual color images appropriately for a life-like color "photo."

The standard video format image is sent to the monitor line-by-line, starting in the top lefthand corner of the screen and working its way down. As the electron beam sweeps the phosphor-coated inside of your monitor or television screen, the phosphors become excited and glow, when struck by the beam (see Figure 2). The voltage of the video signal corresponds to the strength of the beam and the brightness of the picture element (pixel). At the end of every horizontal sweep, a synchronization pulse, which moves the electron beam down and to the beginning of the next line, is received (see Figure 3). At the bottom righthand corner of the image a longer vertical sync pulse is sent to re-position the beam to the upper lefthand corner of the monitor.

However, to make a complete screen image, the electron beam must sweep the entire screen twice, with the second pass filling in between the horizontal lines of the first. This process is known as *interlacing*. Each complete top-to-bottom pass is a field, and two fields make up a video frame. A video frame consists of 525 lines and is sent from the camera to the monitor 30 times a second, but interlacing gives the appearance of a new screen every 1/60 of a second.

Pixel This if You Can

The image that is produced on the closed-circuit monitor in our example is made up of shades of grey ranging from black to white and is called a *continuous tone image* because there is no discernible difference between two adjacent tones of grey. This continuous tone image must be chopped into small, discrete pieces of information that the computer can understand. The smallest element of a display that can be controlled individually is called a picture element, or pixel. The number of pixels that must be digitized is limited by the display resolution of the computer in question. Optimally, the number of pixels in our digitized image would equal the number of pixels in the original image.

A pixel can be described by its two characteristics: brightness and placement. *Quantization* is the process by which the digitizer chops up the original image and assigns brightness and coordinate values to each pixel. Exactly how the digitizer does this is described below.

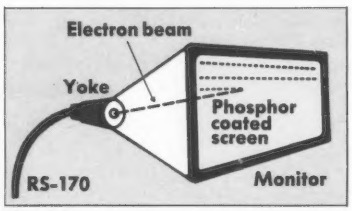


Figure 2.

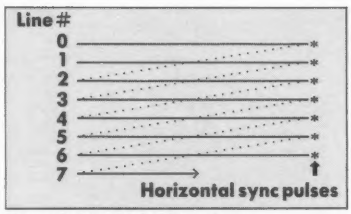
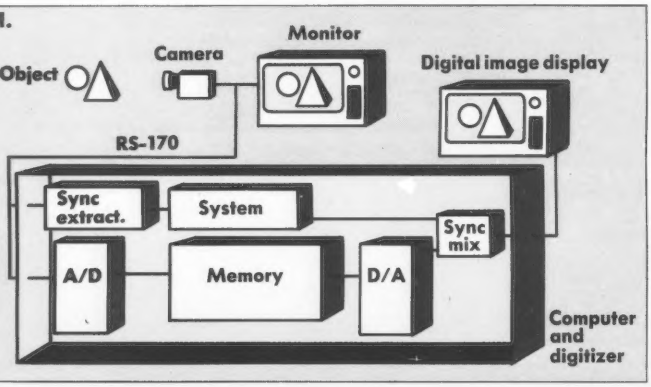


Figure 3. RS-170 field interlacing.

Figure 1.



The RS-170 signal enters most digitizers from a cable that is connected to the video source (in our case, a camera). Inside most digitizers the signal is then routed to both a *sync extractor* and an *analog-to-digital (A/D) converter* (see Figure 1). The extractor concerns itself exclusively with the synchronization pulses that must be used by the system controller for timing purposes. The A/D chip has the job of converting the voltage signal into digital values that the computer can handle.

Simply Brilliant

As mentioned above, the brightness of a pixel is determined by the voltage level of the RS-170 signal at a particular time. When a pixel is at its maximum brightness level, the signal has a certain voltage. Any time this voltage is supplied, the pixel in question is turned up to its maximum brightness. Inside the digitizer there is an analog comparator which compares the incoming voltage to a pre-set level that is called the threshold. The threshold can be set manually by a knob on the digitizer, as is the case with ComputerEyes from Digital Vision, or via software that comes with the package. If the incoming voltage is greater than the threshold, the computer knows that the pixel is brighter than the specified threshold level. To determine exactly how much brighter that pixel is, however, we need to sample its voltage several times with graduated threshold levels. These different thresholds correspond to the levels of grey that make up the grey scale of our digitized image.

Grey Hairs, Grey Scales

If we were dealing with a high-contrast image (a line drawing, for example), we would need only one threshold and two grey levels: white and black (for blank paper and ink respectively). Only one bit of memory would be required to store the brightness information in binary form. The more levels of grey you have, the smoother the transition from one level to the next. However, if you have several grey levels, you need more memory to accommodate the increased information. For each additional level of grey you wish to define, twice as much memory is needed to store the information and increase by one the number of samples that must be taken to determine the brightness. Most digitizers use the *successive approximation* method of analog to digital conversion. Since this method can handle only one pixel per line, a 3-bit digitization would require

three scans. More expensive digitizers use *flash* A/D converters which have individual voltage comparators for each grey level to be detected and converted. An 8-bit quantization image with resolution of 256 x 256 pixels is standard for high end digitizers and allows for 256 different levels of grey. However, since such a device requires approximately 66K of memory, this level of sophistication is overkill for most home computer applications.

Places, Everybody

Once the brightness level of a pixel has been determined, the digitizer must assign coordinates for the pixel so that it can be positioned correctly in the final digitized image. The digitizer software uses a timing delay in conjunction with the sync pulses of the video signal to determine where a pixel belongs. Since most microcomputers aren't fast enough to quantize and store each pixel as it is sent to the system from the video source, several digitizer manufacturers have decided to sample columns of pixels, rather than rows. If the system waits 13 microseconds, for example, each time it receives a horizontal sync pulse, then it will always sample pixels in the same column (see Figure 4). By increasing the time delay by a fraction of a microsecond, the digitizer samples a different column. Each time the brightness of a pixel is determined, the software assigns coordinate values by plugging the delay information into a special algorithm. By gradually incrementing the delay after scanning each frame, the digitizer samples all of the columns of pixels that make up a screen. Once the digitizer has determined the brightness value and coordinates of a pixel, the information is placed into the memory of the computer.

Since flash A/Ds process images so much more quickly, the information would run into a transfer bottleneck if it were piped directly into main memory. Although quantization is fairly quick and easy, the situation is complicated and slowed down by the constant writing to memory to store the image. For this reason, most digitizers that use flash A/Ds are equipped with on-board memory banks that can accept the quantization information as quickly as the flash A/D can process it. Such a configuration is called a *frame grabber*, because it can literally digitize an entire video frame in real-time in contrast to units that take two to ten seconds to digitize a static image.

To display the digitized image, the software must tell the digital-to-analog converter to translate the numeric values that are stored in memory into an electrical signal which has the appropriate synchronization pulses added by a sync mixer. This reconstructed RS-170 signal is then sent to the computer display as a digitized version of our original image. If you know something about computer graphics, you may know that most computers can't display levels of grey, but rather, only black or white; on or off. You may be asking yourself how the computer can possibly display grey scales. Well, quite frankly, most can't.

New Year's Resolution

The Apple IIe computer, for example, has a maximum display resolution of 560 pixels by 192 lines, for a total of 107,520 pixels—each of which can be either on or off at any time (see Figure 5). A television, due to the limits of the RS-170 video specification, can display

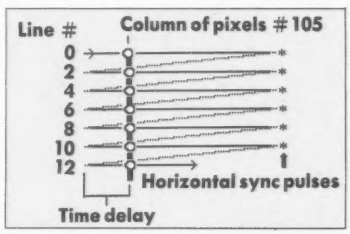


Figure 4. A constant time delay insures that you will sample all of the pixels in a given column (#105 in this example).

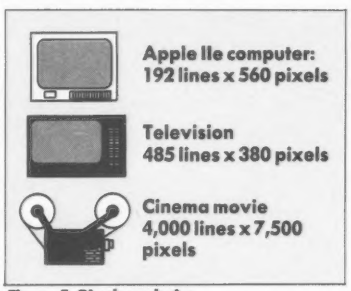


Figure 5. Pixel resolution.

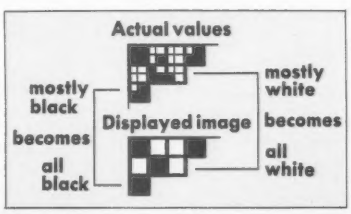


Figure 6.

184,300 pixels, yet each one can be a different brightness level and color. To get the image on the television screen digitized on the computer monitor requires some software tricks.

Since you may have more information in memory than you can display, you must use the information that is most representative of a certain location in an image. The computer takes an average brightness level of several adjacent pixels in the original image and uses this average intensity for the pixel in the digitized image (see Figure 6). A good package, however, saves the grey scale information rather than the displayed image to disk, because the digital image is restricted by the resolution of the computer and its monitor. The grey scale information may be very useful at a later date when using a printer capable of even greater resolution than that of the monitor.

Change is Constant

Now that you have the image up on the screen, you may wish to make slight, or even major, alterations. Images can be processed just as easily as words—however, the right software is needed. As mentioned earlier, most manufacturers bundle image processing software with the digitizer. As you would expect, these packages range from marginally adequate to exceptionally useful. A spartan system is one which simply captures, displays, and then stores an image. More complex packages allow you to clean up the image with commands that smooth surfaces, highlight edges, and remove extraneous data. You can also take an image created by MacVision from Koala, for example, and alter it using the *MacPaint* program. The extent of digital image processing you can do is limited only by the manner in which the image was digitized (what information is retained) and the sophistication of the applications software you are using.

Hopefully, you now have a basic understanding of how computers have been given the gift of sight by video digitizers. The principles are the same for most digitizers, with specifics varying from one model to another. As digital image processing works its way into the mainstream of computing, expect to see more and more interesting applications for digitizers. Prices will drop and digitizing technology will advance—in speed, image quality, and color capabilities. So, take the blindfold off your computer's eyes and let it see the world in a whole new light. ■

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Choosing An Image Processor

Which is right for you?/**Owen Linzmayer**

ComputerEyes

Recently adapted from Digital Vision's Apple II model, ComputerEyes for the Commodore 64 is an inexpensive slow-scan device that plugs into the user I/O port on the back of the computer. Physically, the C64 ComputerEyes is a small 3″ x 4″ x 1-5/8″ box very similar to its Apple cousin (see review in "Apple Cart," October 1984) and is supplied with an Executive software program that handles all of the image acquisition routines. A high-contrast image is scanned in less than six seconds, and realistic grey scale images can be captured using a unique multi-scan process in which the threshold level is automatically increased with each scan. Eight-level grey scale images may take up to 50 seconds to acquire. ComputerEyes is a video acquisition system, not a digital image processor. The Executive program serves to obtain an image and subsequently store it to disk—it does not have sophisticated image processing routines such as noise reduction or edge detection. The user must develop his own software if his needs are not met by the Executive program.

Fortunately, the software is not copy-protected. Digital Vision is now offering, at additional expense, software packages for both the C64 and Apple that allow the user to transform any standard hi-res image into a graphic that is compatible with Broderbund's best-selling *Print Shop*, so custom images can be used in greeting cards and posters.

Diplomat

Originally developed in England by Laurence Payne, the Diplomat digitizer is available in two models: one for the Apple II+ and a more expensive IIe version that includes 64K Extended 80-Column Card facilities. The Apple IIe card occupies the auxiliary slot and fully supports double hi-res graphics. The Apple II+ model may reside in any slot. Both versions are compatible with DOS 3.3, Pascal, and CP/M. The Diplomat differs from most other Apple units in that it can digitize continuously in real time at 60 frames per second, meaning that the subject need not be completely still. A video switch and cable are provided so that you can select "raw" video or digitized images, thus making it easy to fine tune the system on the fly. Moreover, all features of the digitizer can be controlled from the keyboard, and the video thresholds can be set by means of game controllers. The resolution of the Apple II+ version is limited to the standard 280 x 192 pixel hi-res screen. However, in addition to double hi-res capabilities, the IIe unit features "quad" hi-res: 560 x 384 pixels. This is achieved by digitizing alternate video frames into double hi-res pages 1 and 2 using different thresholds computed from those set by the user. This mode provides nine simulated grey scales by rapidly switching the display between the double hi-res pages 30 times per second, yielding a picture that flickers slightly on most monitors with low persistence phosphor. The Diplomat is available with sophisticated digital image processing software in DOS 3.3 format or ROM firmware and is supported by a company newsletter. The Diplomat requires a closed circuit television camera with external synchronization like the Panasonic WV1500 series and can be used with video tape recorders that have freeze frame capabilities.

Sample images. This page: above, Diplomat; left, Computer Eyes. Opposite page: top, Magic; bottom, MacVision.

DS-88 Digisector

Like all of the other digitizers for the IBM-PC, the DS-88 Digisector from Micro Works is an internal board that accepts interlaced RS-170 as well as broadcast NTSC signals. Micro Works was the first company to market digitizers and has been in business since 1977. The DS-88 version of the Digisector provides 512 x 512 pixel scans and yields a maximum of 256 grey scales. A typical 256 x 256 scan takes only four seconds to complete. For set-up and monitoring purposes, the DS-88 produces output comprised of the camera's raw video signal with a superimposed cursor which shows exactly where the Digisector is looking. The DS-88 comes with a menu-driven program called P-See that provides a variety of picture taking and image processing functions. User-definable color palettes allow assignment of up to 16 colors to different grey scale values for emphasis of desired shades with a color monitor. The P-See software requires a PC or XT with 192K, and an IBM color graphics card. The manual supplied with the DS-88 is short and to the point. It contains few diagrams, yet has detailed technical explanations of how the Digisector operates, including two schematics.

FAX640

The Scion FAX640 is a single card that digitizes one frame of a monochrome RS-170 video image to a 16-level grey scale 640 x 408 or 544 x 480 pixel

resolution image—all in 1/30 of a second. Because the image memory and all refresh logic are completely contained on the board, the FAX640 occupies no host memory and can maintain the grabbed image indefinitely. The digitized image can then be transferred in full or in part over the IBM PC data bus to Scion's PC640 for storage, modification, or display. Transfer of the full image takes about a second.

Graphicom Video Digitizer

The Graphicom Video Digitizer is designed to be fully compatible with Cheshire Cat's popular Graphicom graphics program for the TRS-80 Color Computer. The digitizer plugs into the CoCo via a multi-pak cartridge slot extender or a "Y" cable (available for $19.95). Images are digitized at close to real time, allowing you to take a snapshot of a video frame from any RS-170 video source simply by pressing the fire button on the joystick. External controls include horizontal and vertical position, horizontal width, image brightness and contrast. The Graphicom Video Digitizer requires a 64K CoCo with two joysticks and at least one disk drive. Printers supported include Epson, C. Itoh, Gemini-10, Okidata, and Tandy.

Image Capture and Video Display Adaptor

Imaging technology has taken a giant step forward with the recent introduction of the Image Capture and Video Display Adaptor boards from AT&T. These boards fit IBM PC, AT&T, and compatible computers, affording them the ability to store, retrieve, and manipulate color images of very nearly photographic quality.

The AT&T Image Capture Board (ICB) is an ultra hi-res frame grabber and buffer. It enables a microcomputer to digitize television-quality images from a standard composite source (such as a video camera) and to display these images on an analog RGB or NTSC composite monitor. The number of available colors is staggering: up to 32,768 can be displayed simultaneously.

Image capture is accomplished in a sixtieth of a second, and so can use a full-motion video source as well as stills. Resolution is 256 x 256 pixels. The ICB is accompanied by driver and utility software under MS-DOS.

The AT&T Video Display Adaptor (VDA) can display digitized images at the same resolution, with up to 256 simultaneous colors from a palette of over 32,000. The capability to display subtle shading and color transitions gives VDA images a clarity and realism previously obtainable only with complicated systems costing many thousands of dollars.

The high-speed system also allows for graphic manipulation of images without the need for massive amounts of memory. Pictures can be transmitted via modem, and an image can be transmitted at 1200 baud in as little as 15 seconds.

VDA software includes image compression, bit area manipulation, and overlay graphics routines, including geometric shapes and three fonts.—*JJA*

MacVision

Coming from the folks who brought touch tablets to the masses, MacVision from Koala Technologies has been the focus of a lot of attention lately, and rightly so. MacVision is a small, slick box the size of an external 5.25" drive for the Apple II. It was one of the first Mac digitizers to market and has become a favorite among Mac enthusiasts. MacVision also requires the use of one of the Mac's RS-442 serial ports.

The software works as a desktop accessory. Thus, it can be installed on any application disk and used at will given sufficient memory. A small window scan takes approximately five seconds, and scanning the entire Mac video screen requires 22 seconds. The resulting image can be stored in *MacPaint* format for enhancement.

MacVision images are displayed on the Mac screen at the maximum resolution offered: 320 x 240. Each pixel is digitized at 8 bits per pixel. The MacVision software is eloquent—a fine job of programming from Bill Atkinson, the author of *MacPaint*. Although MacVision does not offer extensive image processing capabilities, it does offer the best set-up routines.

Magic

Like all of the current Mac digitizers, the Magic digitizer is an external unit with a footprint slightly larger than a modem. RS-170 video is fed into a jack on the back of the box which is in turn connected to one of the Mac serial ports. The Magic must then be plugged into a wall outlet. Opening the camera icon on the desktop brings up a complex control panel from which you can scan, view images, adjust contrast and brightness, and change patterns. To get the most out of the software the user must maintain a working knowledge of this control panel from which all of the important functions of the system are accessed. For instance, the grey levels are reproduced in a variety of patterns ranging from all black to all white. The patterns in between can be edited by the user to bring out the best in delicate shading areas. And Magic saves its pictures as *MacPaint* documents as well. The Magic system produces images 768 x 480 pixels, but is limited by the Mac screen to display only 512 x 342 pixels—roughly 66% of the digitized image.

MicronEye Bullet

The MicronEye Bullet comes complete with hardware, software, user's guide, camera, and tripod. Images are saved as *MacPaint* files, and the software supports grey tone imaging capabilities through multiple scans.

Micro-Imager

The Micro-Imager is a large unit with a footprint rivaling that of the Mac itself. The system works like most of the others: RS-170 video into the box, digitizer in a serial port on the Mac. The Micro-Imager takes approximately five seconds to scan an image. Like the New Image Magic, the Micro-Imager also allows the user to define the graduated shaded patterns that represent a pseudo grey scale. The user can also select which of six patterns will be used to produce the overall picture. This is a thoughtful special effect and results in stunning images. Lines from both fields of the video frame are used to digitize individually every dot in a 512 x 322 dot image. For high-contrast images like line drawings, the two-shade mode is best. For portraits and such, the multi-shade (grey scale) mode is preferable. Contrast and bright-

ness adjustments are made via knobs on the front control panel. Another hardware feature is an effective color rejection filter that removes virtually all chrominance (color) information from a color signal, yielding the highest quality b & w images.

Slightly less expensive than many of the other digitizers, the Micro-Imager offers good basic processing software, leaving the fancy stuff to designers of sophisticated graphics utilities.

PC-Eye

Chorus Data Systems has introduced the newest member of the company's image processing family, the PC-Eye PC-1200. This high-resolution board is designed to produce up to 640 x 512 x 8-bit (256 levels of grey or color), approaching photograph quality on the computer monitor. The PC-Eye PC-1200 plugs into a full-length expansion slot in the IBM-PC, XT, AT and compatibles. Video images can be input through any of the four separate video input channels and are subsequently stored directly into PC main memory or graphics adapter memory. A 640 x 480 x 8-bit image can be captured in 0.6 seconds. Unique features include external trigger, NTSC color filter option, 4-bit digital input and output, and programmable gain and offset "trim." Support is provided for graphics display adapter cards including IBM and compatibles, Hercules, and Tecmar. The GA-3 "revolution" card offers full display of 256 levels of grey or colors with 512 x 512 resolution. The GA-3 color pallette includes 16.7 million colors. An on-board graphics controller provides hardware speed for such functions as pan, zoom, and drawing.

PCvision Frame Grabber

PCvision Frame Grabber, a real-time video image acquisition and display module for the IBM PC and XT, includes a hardware module that plugs directly into an expansion slot in the IBM, comprehensive software driver routines, full user documentation, and all required interconnecting cables. The PCvision Frame Grabber digitizes images into 6-bit pixel data and stores them in an on-board 512 x 512 frame memory. Two additional bits enable two planes of

Digital Image Processors

Product	System*	Price	Manufacturer
ComputerEyes	Commodore, Apple II	$ 130, $ 350 w/ camera	Digital Vision, Inc. 14 Oak St., Suite 2 Needham, MA 02192 (617) 444-9040
420 ON READER SERVICE CARD			
Diplomat	Apple II	$ 295	Computech Systems 168 Finchley Rd. London, NW3 6HP England 01-794-0202
421 ON READER SERVICE CARD			
DS-88 Digisector	IBM, Apple II, Tandy Color Computer, S-100 S-50	$ 350	The Micro Works P.O. Box 1110 Del Mar, CA 92014 (619) 942-2400
422 ON READER SERVICE CARD			
FAX640	IBM	$1595	Scion Corp. 12310 Pinecrest Rd. Reston, VA 22091 (703) 476-6100
423 ON READER SERVICE CARD			
Graphicom	Tandy Color Computer	$ 200	Computize P.O. Box 207 Langhorne, PA 19047 (215) 946-7260
424 ON READER SERVICE CARD			
Image Capture Board; Video Display Adapter	IBM	$1295; $ 695	AT&T Consumer Products 2002 Wellesley Blvd. Indianapolis, IN 46219 (317) 352-6120
425 ON READER SERVICE CARD			
MacVision	Macintosh	$ 399	Koala Technologies 3100 Patrick Henry Dr. Santa Clara, CA 95052 (408) 986-8866
426 ON READER SERVICE CARD			
Magic	Macintosh	$ 350; $ 495 w/ camera	New Image Technology 10300 Greenbelt Rd. Seabrook, MD 20706 (301) 464-3100
427 ON READER SERVICE CARD			
MicronEye Bullet	Macintosh, Apple II, IBM, Tandy Color Computer, TI PC, C64	$ 295	Micron Technology Vision Systems Group 2805 E. Columbia Rd. Boise, ID 83706 (208) 383-4106
428 ON READER SERVICE CARD			

Product	System*	Price	Manufacturer
Micro-Imager	Macintosh	$ 350	Servidyne Systems 1735 DeFoor Pl. P.O. Box 93846 Atlanta, GA 30377 (404) 352-2050
429 ON READER SERVICE CARD			
PC-Eye	IBM	$1495	Chorus Data Systems P.O. Box 370 6 Continental Blvd. Merrimack, NH 03054 (603) 424-2900
430 ON READER SERVICE CARD			
PCvision Frame Grabber	IBM	$2995	Imaging Technology 600 W. Cummings Park Woburn, MA 02801 (617) 938-8444
431 ON READER SERVICE CARD			
PI-101 PhotoImager	Apple II	$ 995 w/ camera	Commsoft 665 Maybell Ave. Palo Alto, CA 94306 (415) 493-2184
432 ON READER SERVICE CARD			
Private Eye	Macintosh	$ 595	I/O Video 222 Third St. Cambridge, MA 02142 (617) 547-4141
433 ON READER SERVICE CARD			
ThunderScan	Macintosh	$ 229	Thunderware Inc. 19G Orinda Way Orinda, CA 94563 (415) 254-6581
434 ON READER SERVICE CARD			
Vidx-1	Tandy Color Computer	$ 100	Grafx P.O. Box 254 West Mifflin, PA 15122 (412) 466-6974
435 ON READER SERVICE CARD			

Products Not Reviewed

Palette Computer Image Recorder	IBM, Apple II, DEC Rainbow and Pro, Compaq, AT&T 6300	$1799	Polaroid Corporation 784 Memorial Drive—3 Cambridge, MA 02139 (800) 225-1618
436 ON READER SERVICE CARD			
Video Van Gogh	IBM	$ 345	Tecmar 6225 Cochran Rd. Cleveland, OH 44139 (216) 349-0600
437 ON READER SERVICE CARD			

*Where a product is available for more than one system, the system listed first is the one reviewed, and the price listed is for that version. Specifications and prices vary for different versions. Contact the manufacturer for details on the product that runs on your computer.

graphic overlays, which can be used for generating and positioning text or graphics anywhere on the image without disturbing the stored video data. The unique architecture of the Frame Grabber enables it simultaneously to acquire and display 30 frames per second. Programmable look-up tables on the output signal allow arbitrary transformation of pixel intensity prior to display on an external monitor. The Frame Grabber can use its internal crystal to generate composite sync or horizontal and vertical syncs to drive the video source. Using three Frame Grabbers allows full-color image processing. In this configuration, one module is designated a master and generates the system timing for the other two modules. Each board digitizes, stores, and displays one primary color: red, green, or blue. NTSC composite color is, unfortunately, not supported.

PI-101 PhotoImager

The PI-101 PhotoImager is actually an entire digital image processing system designed around a digitizer card initially introduced in late 1982. The PI-101 includes everything needed to digitize, display, communicate, and store hi-res grey scale and color photos. The PhotoImager consists of the PC-100 PhotoCaster digitizer/slow-scan television modem board; PV-100 PhotoViewer color graphics display board; a b & w RS-170 camera with lens, tripod and cables; four software disks; and two reference manuals. Images are digitized in eight seconds at a resolution of 128 x 128 pixels, with dithering of 16 levels of grey in the black and white mode and 4096 colors per pixel in the color mode. To achieve color digitization with a b & w camera, the PI-101 makes three successive scans, prompting the user to place a red, green, or blue filter in front of the lens before each scan. Although tedious, the result is a surprisingly realistic color image. When routed through the companion PhotoViewer color graphics board, images contain 320 x 200 pixel resolution on a true 16-level grey scale.

One very interesting feature of the PhotoCaster digitizer board is that it is equipped with a slow-scan television modem that can be connected to a radio transmitter and receiver to send and receive pictures. The PhotoCaster modem is compatible with most amateur SSTV equipment in use today. Additionally, the PhotoCaster can digitally transmit high quality photos over the telephone lines in one to four minutes. The PhotoViewer board also satisfies the proposed NAPLPS videotex/teletext protocol standards for resolution, color and grey scale.

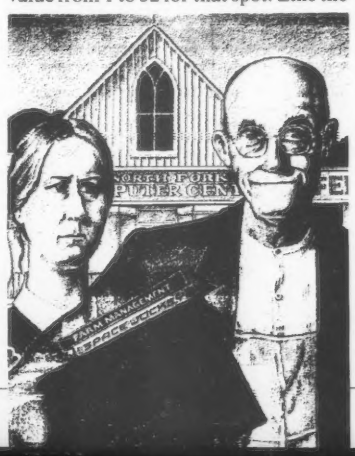
Private Eye

Probably the most impressive feature of Private Eye is that it can capture moving video images, so the object being scanned does not have to remain still for the length of the scan. In fact, Private Eye can capture a complete video frame in real time (1/30 second) compared to conventional digitizers which require several full seconds. Each video frame is digitized into a 512 x 512 pixel image that may be viewed on the Mac with a movable window. As is standard with all Mac digitizers, the images can be saved as *MacPaint* files to insure compatibility with all graphics packages. According to the manufacturer, Private Eye uses a patent-pending "spray paint" random dot pattern generator, which provides images with near continuous shades of grey. Unlike the other Mac digitizers, Private Eye allows TV adjustments to be made when viewing the image on the Mac itself, rather than on an external monitor.

ThunderScan

The ThunderScan unit is unique in that it does not accept RS-170 video input from any video source—it is a self-contained unit that replaces the ribbon cartridge inside the Imagewriter printer. True to its name, ThunderScan "scans" any document, drawing, or image that can be fed into the Imagewriter like paper. It shines a beam of light at precise spots on the paper, and a sensitive photosensor detects how much light is reflected and determines a grey scale value from 1 to 32 for that spot. Like the Koala software for the MacVision, the ThunderScan software was written by an Apple author. The man behind the keyboard this time was Mac team member and software priest, Andy Hertzfeld, author of the Switcher accessory. The ThunderScan software allows you to scan images of various sizes up to 8″ x 10″ with a 512K Mac. However, this process takes up to 20 minutes to complete—a rather long time, compared to the scant seconds it takes most video digitizers. But remember, this is optical digitization, and provides precise reproduction of flat documents since there is no need to bother with correct lighting and contrast levels. ThunderScan also lets the user enlarge or reduce the image before scanning. Image magnification is available from 25 to 400% of the original. Other useful adjustments are available after the image has been digitized. These include contrast, brightness, and pattern editing.

One major drawback of ThunderScan is that the scanning unit must be replaced by the printer ribbon each time a picture is printed. This blow can be softened by waiting to print a group of images at the end of an acquisition session. Images can be stored in *MacPaint* in ThunderScan format and selected by the user. Like all digital information, ThunderScan images use large amounts of internal memory and disk space.



ThunderScan sample image.

Vidx-1

The Vidx-1 video digitizer is a small box that plugs into the RS-232 serial port on the back of the TRS-80 Color Computer. Unlike the Computize unit, there is no need for Y-cables or multi-paks. In addition, the Vidx-1 digitizer is the only system that runs on the basic 16K cassette CoCo, as well as systems with additional memory and disk drives, including the Color Computer 2.

The Vidx-1 hardware has two knobs; one controls image contrast, the other, image width. The width knob controls the speed at which Vidx scans the RS-170 image and can horizontally stretch or compress the digitized image on the CoCo screen. It takes approximately four seconds to digitize an image, and the resulting picture can be saved to disk in either Graphicom or Radio Shack standard binary formats. Most users will want to get hardcopies of their images; the Vidx software supports printouts on the Prowriter 8510. Cost: $99.95 (Vidx-1), $124.95 (Vidx-2, includes a two-port RS-232 switcher). ■

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Quadboard, no RAM, expand to 384K	$ 295	$ 225
Quadboard 256K, to 384K, S/P/CC	$ 675	$ 269
Quadboard, 384K (full), S/P/CC/G	$ 795	$ 295
Quadboard II, no RAM, to 256K	$ 295	$ 215
Quadboard II, 64K, to 256K, 2S/CC	$ 395	$ 265
Quadboard II, 256K, 2S/CC	$ 595	$ 395
Quad 512 + 64K w/serial port	$ 325	$ 245
Quadcolor I, board, 4 colors	$ 295	$ 195
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TG PRODUCTS, Joystick	$ 30	$ 22
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MICROSOFT, Booster 128K w/Mouse	$ 495	$ 329
MOUSE SYSTEMS, Mouse w/software	$ 195	$ 125
QUADRAM, Expansion Chassis	$ 695	$ 540
Memory Expansion Board 128K	$ 275	$ 215
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BRODERBUND, Bank St. Writer (PC or Jr.)	$ 80	$ 49
CDEX, Training Programs—Large Inventory	$ 70	$ 45
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Tax Advantage	$ 70	$ 40
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DATA TRANS., Fontrix	$ 125	$ 79
DOW JONES, Investment Evaluator	$ 149	$ 97
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FOX & GELLER, Quickcode III	$ 295	$ 185
HARVARD, Total Project Manager	$ 495	$ 295
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HUMAN EDGE, Mind Prober (PC or Jr.)	$ 50	$ 29
Sales Edge or Management Edge, ea.	$ 250	$ 159
Negotiation Edge	$ 295	$ 185
INFOCOM, Cornerstone	$ 495	$ 319
KENSINGTON, Easy Link Mail Manager	$ 95	$ 59
LIFETREE, Volkswriter Deluxe	$ 295	$ 159
LIVING VIDEOTEXT, Think Tank	$ 195	$ 95
LOTUS, 1-2-3	$ 495	$ 309
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QUE, Using 1-2-3	$ 18	$ 14
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BPI, Personal Accounting	$ 99	$ 63
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CIRCLE 109 ON READER SERVICE CARD

WHAT'S NEW

The latest in hardware and software/**Russ Lockwood**

PCjr to PC AT

Racore has introduced the ATcessory, a unit with 1.2Mb floppy disk drive, parallel port, clock calendar, direct memory access controller, PC/PCjr switch, and separate power supply for the IBM PCjr. The ATcessory allows users to run IBM PC and PC AT software and provides complete floppy disk interchangeability with the AT. It carries a suggested retail price of $899.

Racore also announced Racore-Net, a local area network (LAN) that allows up to 16 PCjrs, PCs, XTs, and ATs to be linked together. A gateway is included to hook Racore-Net into the recently announced IBM LAN. The expected retail price for the networking hardware is approximately $200.

Racore
10 Victor Sq.
Scotts Valley, CA 95066
(408) 438-7255

CIRCLE **439** ON READER SERVICE CARD

Victor VPC

Victor Technologies, back from Chapter 11 bankruptcy proceedings after striking a deal with Datatronic AB of Sweden, has announced two computers, the VPC and the VI.

The VPC is an IBM PC compatible built around an 8088 microprocessor. It comes with 256K RAM expandable to 640K, two 360K floppy disk drives or one floppy drive and one 15Mb or 30Mb hard disk drive, one parallel port, seven expansion slots, detached keyboard, and either a monochrome or color monitor.

The VI is also built around the 8088 and comes with 256K expandable to 2Mb. The floppy drives read 40-track 360K IBM PC disks as well as 80-track IBM PC AT 1.2Mb disks, and 10Mb, 20Mb, and 30Mb hard disk drives are available. The machine includes two RS-232C serial ports, one parallel port, detached keyboard, and either a monochrome or color monitor.

Victor Technologies
380 El Pueblo Rd.
Scotts Valley, CA 95066
(408) 438-6680

CIRCLE **444** ON READER SERVICE CARD

Macintosh Serial Ports

Kensington Microware has introduced the Macaccessories A-B Box, a box that connects to the Macintosh serial port and gives users two serial ports. It retails for $99.95.

Kensington Microware
251 Park Ave. South
New York, NY 10010
(212) 475-5200

CIRCLE **440** ON READER SERVICE CARD

Daisywheel for Home

Juki has released the 6000, a $295, 10 cps bidirectional daisywheel printer with a Centronics parallel or RS-232C serial port. Six printwheels and an optional parallel port to attach the 6000 to the Commodore 64 are available.

Juki
299 Market St.
Saddle Brook, NJ 07662
(201) 368-3666

CIRCLE **441** ON READER SERVICE CARD

Commodore Modem

Our May 1985 cover story, "Modem Magic," focused on understanding, choosing, and using a modem. Since then, Cardco has released the Mod-1, a 300 baud modem for the Commodore 64. It includes a full-featured terminal package complete with file conversion utility programs, a rudimentary word processor, and the ability to transmit and receive hi-res pictures created with Cardco's *Paint Now!* and *Graph Now!* graphics programs and Cardco's video digitizer. The Mod-1 sells for $89.95.

Cardco
300 S. Topeka
Wichita, KS 67202
(316) 267-3807

CIRCLE **445** ON READER SERVICE CARD

Surge Protector

Computer Power Solutions has introduced a six-plug surge protector called the Electra Guard System 18 that protects electronic devices from surges, spikes, transients, and overvoltages. It includes a 15-foot cord from wall socket to surge protector and a six-foot cord with a remote rocker switch. Electra Guard System 18 sells for $99.95.

Computer Power Solutions
8800 49th St North
Pinellas Park, FL 33565
(800) 237-6010
(813) 544-8801

CIRCLE **442** ON READER SERVICE CARD

Building a Better Mouse

Data Input Group has introduced McBall, an $89.95 trackball that is directly interchangeable with the Apple mouse. The trackball has two buttons, one for "dragging" and the other for "clicking."

Data Input Group
110 Pioneer Way Suite H
Mountain View, CA 94041
(415) 964-4464

CIRCLE **443** ON READER SERVICE CARD

Modem Mailbox

Anchor Automation has introduced the Signalman Computer Mailbox, a modem message center that receives and stores incoming messages whether or not the computer is on-line. It comes with 64K RAM, a message waiting light, and three levels of password protection. It retails for $299.

Anchor Automation
6913 Valjean Ave.
Van Nuys, CA 91406
(818) 997-7758

CIRCLE **446** ON READER SERVICE CARD

TeleCompaq

Compaq Telecommunications has announced six models of the new TeleCompaq, an integrated computer and voice/data communications system. Built around a Compaq transportable computer with internal 1200/300 baud modem, the TeleCompaq also includes a Z80 microprocessor with 64K RAM for telephone and data operations, a separate phone unit, and function keys for access to 80 user-programmable "speed dial" numbers. Depending on configuration, the TeleCompaq retails for $4195 to $6395.

Compaq
15182 Marsh Ln.
Dallas, TX 75244
(214) 484-4200

CIRCLE **447** ON READER SERVICE CARD

Apple II Word Processor

Batteries Included has converted its *PaperClip* word processor to run on the Apple IIe and IIc computers. Features include automatic paging, headers, footers, 80-column display, preview mode, columnization, keyboard macros, 250-column formats, search and replace, mail merge, and on-screen help. *PaperClip* retails for $59.95.

Batteries Included
30 Mural St.
Richmond Hill, Ontario
L4B 1B5 Canada
(416) 881-9816

CIRCLE **448** ON READER SERVICE CARD

Macintosh Languages

ExperTelligence has introduced *ExperLisp*, a compiled version of the Lisp programming language for the 512K Macintosh. Lisp is used for the development of expert systems and other artificial intelligence applications. *ExperLisp* retails for $495.

ExperTelligence has also released a French version of its *ExperLogo* programming language for the Macintosh. It retails for $149.95

ExperTelligence
559 San Ysidro Rd.
Santa Barbara, CA 93108
(805) 969-7874

CIRCLE **449** ON READER SERVICE CARD

Home Accounting

United Software Industries has released *In-House Accountant*, a general ledger accounting system with built-in mailing list, report generator, and graph analysis. It maintains up to 250 accounts, requires a 192K IBM PC or compatible, and retails for $179.95.

United Software Industries
1880 Century Park East
Los Angeles, CA 90067
(213) 556-2211

CIRCLE **452** ON READER SERVICE CARD

Practical Programs has unveiled *Financial Partner*, a bookkeeping system for professionals writing fewer than 150 checks per month. It includes record retrieval, report generator, and checkbook balancer. It requires a Commodore 64 and retails for $74.95.

Practical Programs
P.O. Box 93104
625 N. Milwaukee St.
Milwaukee, WI 53203
(414) 278-0829

CIRCLE **453** ON READER SERVICE CARD

Practical Peripherals has introduced *Basic Home Accounting* for Apple II computers. The bookkeeping program accepts up to 100 budget codes, performs graph analysis, and includes a password protection system. It retails for $59.

Practical Peripherals
31304 Via Colinas
West Lake Village, CA 91362
(818) 991-8200

CIRCLE **454** ON READER SERVICE CARD

IBM PC Graphics Package

Spectrum Holobyte has introduced *Art Studio*, a graphics package for the IBM PC family that creates four-color pictures using keyboard, mouse, or graphics tablet input. It features a wide array of dots, lines, ellipses, arcs, radial lines, concentric circles, and boxes and includes eraser, airbrush, cut and paste, and text capabilities. The entire package retails for $49.95.

Spectrum Holobyte
1050 Walnut, Suite 325
Boulder, CO 80302
(303) 443-0191

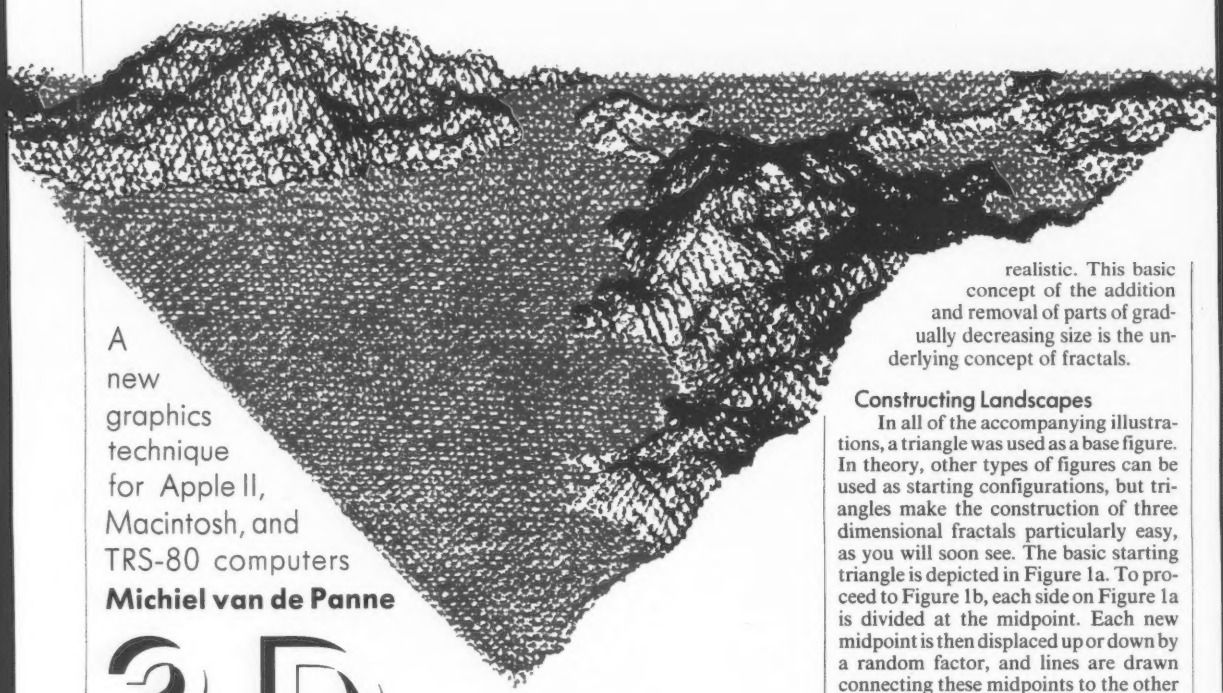
CIRCLE **450** ON READER SERVICE CARD

Laboratory Operations

Lotic Enterprises has announced *Microcomputer Assisted Quality Assurance*, a combination book and disk package with 23 Basic programs designed specifically for laboratory quality assurance work. Programs include Atomic Absorption Detection Limits, Corrosive Tendency, Curve Fitting, Standard Deviation, and Anion-Cation Balance. The package retails for $81, and new programs will be provided free to original purchasers.

Lotic Enterprises
5301-1 Dunsmuir Rd.
Bakersfield, CA 93309
(805) 325-7348

CIRCLE **451** ON READER SERVICE CARD



A new graphics technique for Apple II, Macintosh, and TRS-80 computers

Michiel van de Panne

3-D Fractals

If you have no idea of what a fractal is, you are not alone. Fractals are, however, being used increasingly in a variety of modelling applications where it is desirable to obtain realistic simulations of such natural phenomena such as crystal growth, coastlines, and clouds. In this article, I will focus primarily on how to build realistic three-dimensional landscapes that are constructed with the aid of many random numbers.

Fractals: An Explanation

A fractal is an object that is put together by beginning with some basic shape such as a sphere and then adding or removing fractions of it. First, large fractions, or chunks, are removed or added in a random fashion. Then, in the next step of the procedure, smaller sized fractions are similarly removed or added. This process is repeated until the desired effect has been achieved.

It can easily be seen how this process can be used to construct landscapes when examining the structure of a mountain or other such natural phenomena in detail. A mountain can be thought of as a very large chunk of rock in the shape of a pyramid with parts taken out in some spots and added on in others. These parts serve to create the ridges, crests, bowls, etc. seen on real mountains. When smaller parts are added and removed from our model of a mountain, the resulting object becomes even more realistic. This basic concept of the addition and removal of parts of gradually decreasing size is the underlying concept of fractals.

Constructing Landscapes

In all of the accompanying illustrations, a triangle was used as a base figure. In theory, other types of figures can be used as starting configurations, but triangles make the construction of three dimensional fractals particularly easy, as you will soon see. The basic starting triangle is depicted in Figure 1a. To proceed to Figure 1b, each side on Figure 1a is divided at the midpoint. Each new midpoint is then displaced up or down by a random factor, and lines are drawn connecting these midpoints to the other midpoints created.

To create Figure 1c from Figure 1b, the same procedure is followed. The midpoint of each side is moved up or down by random amount and is then connected with straight lines to the surrounding points. Each time this procedure is repeated the number of triangles quadruples. We began in Figure 1a with one triangle, produced Figure 1b with four triangles and Figure 1c with 16 triangles, and end up in Figure 1g with a total of 4096 individual triangles.

When running the program, you have the option of choosing the number of times you wish to repeat the quadrupling process for the triangles. This is done by replying appropriately to the question Number of Levels?. Replying with 1 to indicate one level will result in a figure with four triangles. In other words, the dividing process will have been repeated once. Replying 2 will result in 16 triangles as a result of the dividing process having been repeated twice. Level 3 results in 64 triangles; Level 4, in 256 triangles, etc.

The Sea Level

You will have noticed at this point that all the illustrations in the article except for those in Figure 1 have a sea or

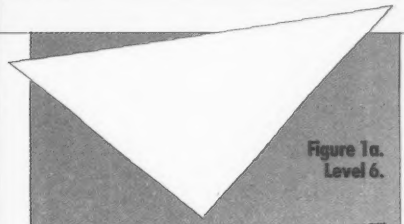


Figure 1a. Level 6.

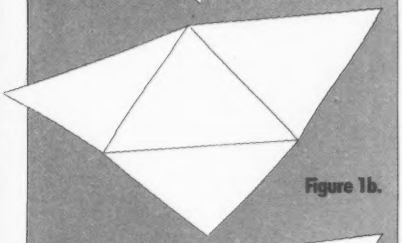


Figure 1b.

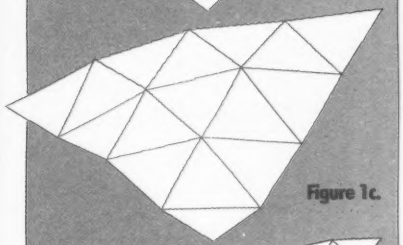


Figure 1c.

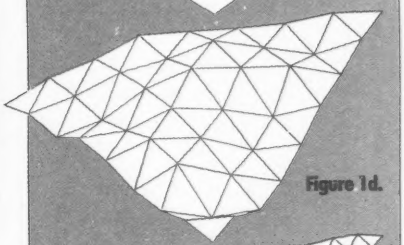


Figure 1d.

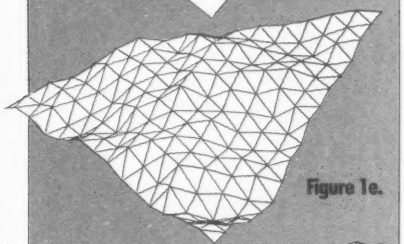


Figure 1e.

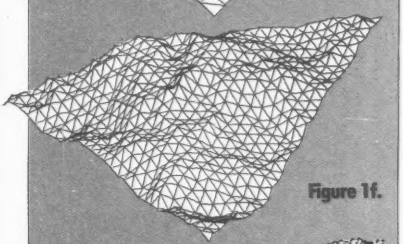


Figure 1f.

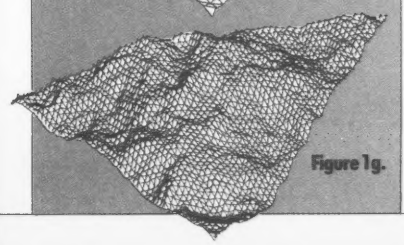


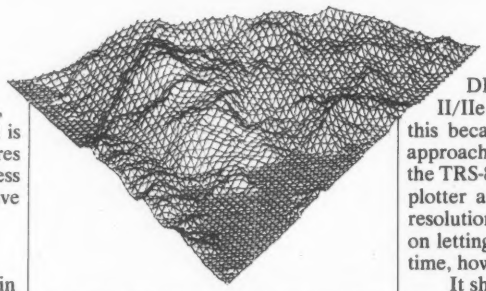
Figure 1g.

Listing 1. TRS-80 Model I/III/4 version with CGP-115 plotter.

```
10 DEFINT A-N
20 DIM D(64,32)
30 INPUT"NUMBER OF LEVELS";LE
40 DS=2:FOR N=1 TO LE:DS=DS+2^(N-1):NEXT N
50 MX=DS-1:MY=MX/2:PI=3.1416:RH=PI*30/180:VT=RH*1.2
60 FOR N=1 TO LE:L=10000/1.8^N
70   PRINT"WORKING ON LEVEL";N
80   IB=MX/2^N:SK=IB*2
90   GOSUB 150  :REM *** ASSIGN HEIGHTS ALONG X IN ARRAY ***
100   GOSUB 220  :REM *** ASSIGN HEIGHTS ALONG Y IN ARRAY ***
110   GOSUB 290  :REM *** ASSIGN HEIGHTS ALONG DIAG. IN ARRAY ***
120 NEXT N
130 GOTO 640  :REM *** DRAW ***
140 REM * HEIGHTS ALONG X *
150 FOR YE=0 TO MX-1 STEP SK
160   FOR XE=IB+YE TO MX STEP SK
170   AX=XE-IB:AY=YE:GOSUB 370  :D1=D:AX=XE+IB:GOSUB 370  :D2=D
180   D=(D1+D2)/2+RND(L/2)-L/4:AX=XE:AY=YE:GOSUB 420
190   NEXT XE
200 NEXT YE:RETURN
210 REM * HEIGHTS ALONG Y *
220 FOR XE=MX TO 1 STEP -SK
230   FOR YE=IB TO XE STEP SK
240   AX=XE:AY=YE+IB:GOSUB 370  :D1=D:AY=YE-IB:GOSUB 370  :D2=D
250   D=(D1+D2)/2+RND(L/2)-L/4:AX=XE:AY=YE:GOSUB 420
260    NEXT YE
270 NEXT XE:RETURN
280 REM * HEIGHTS ALONG DIAG. *
290 FOR XE=0 TO MX-1 STEP SK
300   FOR YE=IB TO MX-XE STEP SK
310   AX=XE+YE-IB:AY=YE-IB:GOSUB 370  :D1=D
320   AX=XE+YE+IB:AY=YE+IB:GOSUB 370  :D2=D
330   AX=XE+YE:AY=YE:D=(D1+D2)/2+RND(L/2)-L/4:GOSUB 420
340   NEXT YE
350 NEXT XE:RETURN
360 REM *** RETURN DATA FROM ARRAY ***
370 IF AY>MY THEN 390
380 BY=AY:BX=AX:GOTO 400
390 BY=MX+1-AY:BX=MX-AX
400 D=D(BX,BY):RETURN
410 REM *** PUT DATA IN ARRAY ***
420 IF AY>MY THEN 440
430 BY=AY:BX=AX:GOTO 450
440 BY=MX+1-AY:BX=MX-AX
450 D(BX,BY)=D:RETURN
460 REM *** PUT IN SEA LEVEL HERE ***
470 IF XO<>-999 THEN 500
480 IF ZZ<0 THEN GOSUB 1070 :Z2=ZZ:ZZ=0:GOTO 620
490 GOSUB 1090 :GOTO 610
500 IF Z2>0 AND ZZ>0 THEN 610
510 IF Z2<0 AND ZZ<0 THEN Z2=ZZ:ZZ=0:GOTO 620
520 W3=ZZ/(ZZ-Z2):X3=(X2-XX)*W3+XX:Y3=(Y2-YY)*W3+YY:Z3=0
530 ZT=ZZ:YT=YY:XT=XX
540 IF ZZ>0 THEN 590
550 REM *** GOING INTO WATER ***
560 ZZ=Z3:YY=Y3:XX=X3:GOSUB 950
570 GOSUB 1070 :ZZ=0:YY=YT:XX=XT:Z2=ZT:GOTO 620
580 REM *** COMING UP OUT OF WATER ***
590 ZZ=Z3:YY=Y3:XX=X3:GOSUB 950
600 GOSUB 1090 :ZZ=ZT:YY=YT:XX=XT
610 Z2=ZZ
620 X2=XX:Y2=YY:RETURN
630 REM **** DISPLAY HERE ****
640 GOSUB 1110 :REM *** SET UP PLOTTING DEVICE OR SCREEN ***
650 XS=.04:YS=.04:ZS=.04:REM **** SCALING FACTORS *
660 FOR AX=0 TO MX:XO=-999:FOR AY=0 TO AX
670 GOSUB 370  :ZZ=D:YY=AY/MX*10000:XX=AX/MX*10000-YY/2
680 GOSUB 940  :NEXT AY:NEXT AX
690 FOR AY=0 TO MX:XO=-999:FOR AX=AY TO MX
700 GOSUB 370  :ZZ=D:YY=AY/MX*10000:XX=AX/MX*10000-YY/2
710 GOSUB 940  :NEXT AX:NEXT AY
720 FOR EX=0 TO MX:XO=-999:FOR EY=0 TO MX-EX
```

(continued on next page)

water level, making the landscapes look like land with lakes, or islands, depending on how much of the land is above the water level. All these figures are constructed with the same process used to obtain Figure 1g, only they have a sea or water level inserted.



Running the Program

The programs as they are shown in the listings will produce only landscapes with sea levels. In the version for the Radio Shack Model I/III/4 with CGP-115 plotter and the Apple II version, the sea is colored blue while the land is colored black and white. Because the Apple Macintosh lacks color, the sea or water is indicated by dots. If you desire to produce a plot without a sea level inserted, simply change line 470 to read:

470 RETURN

This applies to the versions for all three computers.

The only input the program requires is the number of levels you wish. This changes the number of triangles of which the resulting figure is made and hence, how realistic the resulting image is. A level 3 figure takes only about five minutes to plot, but does not produce a very realistic looking landscape. On the other hand, a level 6 figure might take an hour, but will produce a landscape that is very realistic. Generally, a good compromise is level 5. As listed, the programs create levels from 1 to 6.

Possible Modifications

If you have enough memory in your computer, you may wish to modify the program so that you can do up to seven levels. The enlarged illustration on page 82 is a figure with seven levels (16384 triangles). The only change required to do this is to change the dimension statement in line 20 from DIM D(64,32) to DIM D(128,64). On the Apple II/IIe there is not much point in doing this because the triangles are already approaching the pixel size in level 6. On the TRS-80 Model I/III/4 with CGP-115 plotter and the Apple Macintosh, the resolution is sufficient. You should plan on letting the computer plot for a long time, however.

It should not be difficult to modify the program to run on a different type of computer, providing it supports a sufficiently complex version of Basic and has a graphics resolution of at least 150 x 200 or so. All the program lines that are computer dependent are located at the end of the program from line 1030 on.

Acknowledgements

The technique used in the program for generating the landscapes is not my own. It is based on a technique described in the September 1984 issue of *Scientific American*. They in turn credit the original idea of fractal geometry to Benoit Mandlebrot, "the father of fractals", and the further development of the idea to Lucasfilm Ltd. ■

Listing 1. *(continued)*

```
730 AX=EX+EY:AY=EY:GOSUB 370  :ZZ=D:YY=AY/MX*10000
740 XX=AX/MX*10000-YY/2:GOSUB 940  :NEXT EY:NEXT EX
750 GOTO 1130 :REM *** DONE PLOTTING, GOTO END
    LOOP ***
760 REM *** ROTATE ***
770 IF XX<>0 THEN 800
780 IF YY<=0 THEN RA=-PI/2:GOTO820
790 RA=PI/2:GOTO820
800 RA=ATN(YY/XX)
810 IF XX<0 THEN RA=RA+PI
820 R1=RA+RH:RD=SQR(XX*XX+YY*YY)
830 XX=RD*COS(R1):YY=RD*SIN(R1)
840 RETURN
850 REM *** TILT DOWN ***
860 RD=SQR(ZZ*ZZ+XX*XX)
870 IF XX=0 THEN RA=PI/2:GOTO900
880 RA=ATN(ZZ/XX)
890 IF XX<0 THEN RA=RA+PI
900 R1=RA-VT
910 XX=RD*COS(R1)+XX:ZZ=RD*SIN(R1)
920 RETURN
930 REM *** MOVE OR PLOT TO (XP,YP) ***
940 GOSUB 470
950 XX=XX*XS:YY=YY*YS:ZZ=ZZ*ZS
960 GOSUB 770  : REM *** ROTATE ***
970 GOSUB 860  : REM *** TILT UP ***
980 IF XO=-999 THEN PR$="M" ELSE PR$="D"
990 XP=INT(YY)+CX:YP=INT(ZZ)
1000 GOSUB 1030
1010 RETURN
1020 REM *** PLOT LINE HERE ***
1030 LPRINTPR$;XP;",";YP:XO=XP
1040 REM
1050 RETURN
1060 REM *** SWITCH TO SEA COLOR ***
1070 LPRINT"C1":RETURN
1080 REM *** SWITCH TO LAND COLOR ***
1090 LPRINT"C0":RETURN
1100 REM *** SET UP PLOTTING DEVICE OR SCREEN ***
1110 LPRINT CHR$(18):LPRINT"I":RETURN
1120 REM *** END LOOP ***
1130 LPRINT"A"
1140 END
```

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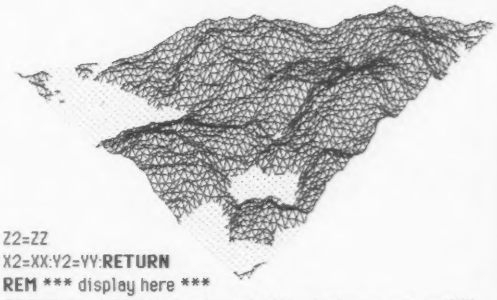
Listing 2. Apple Macintosh version.

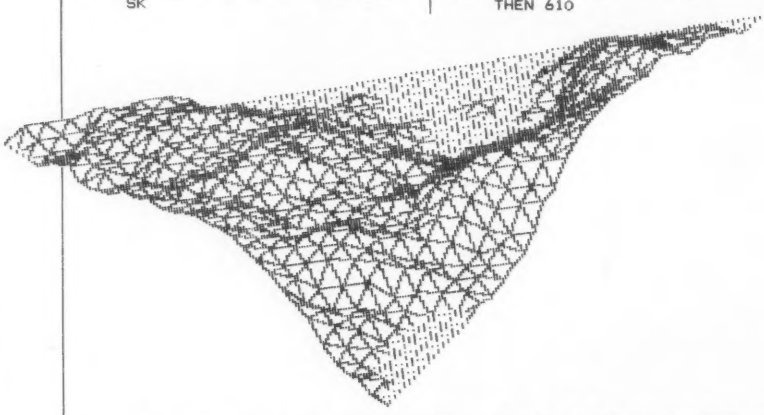
```
10 DEFINT A-N
20 DIM D(64,32):RANDOMIZE
30 INPUT"Number of levels";LE
40 DS=2:FOR N=1 TO LE:DS=DS+2^(N-1):NEXT N
50 MX=DS-1:MY=MX/2:PI=3.1416:RH=PI*30/180:VT=RH*1.2
60 FOR N=1 TO LE:L=10000/1.8^N
70  PRINT"Working on level";N
80  IB=MX/2^N:SK=IB*2
90  GOSUB 150:REM *** Assign heights along x in array ***
100  GOSUB 220:REM *** Assign heights along y in array ***
110 GOSUB 290:REM *** Assign heights along diag. in array ***
120 NEXT N
130 GOTO 640:REM *** draw ***
140 REM *** heights along x ***
150 FOR YE=0 TO MX-1 STEP SK
160  FOR XE=IB+YE TO MX STEP SK
170  AX=XE-IB:AY=YE:GOSUB 370:D1=D:AX=XE+IB:GOSUB 370:D2=D
180  D=(D1+D2)/2+RND(1)*L/2-L/4:AX=XE:AY=YE:GOSUB 420
190  NEXT XE
200 NEXT YE:RETURN
210 REM *** heights along y ***
220 FOR XE=MX TO 1 STEP -SK
230  FOR YE=IB TO XE STEP SK
240  AX=XE:AY=YE+IB:GOSUB 370:D1=D:AY=YE-IB:GOSUB 370:D2=D
250  D=(D1+D2)/2+RND(1)*L/2-L/4:AX=XE:AY=YE:GOSUB 420
260  NEXT YE
270 NEXT XE:RETURN
280 REM *** heights along diag. ***
290 FOR XE=0 TO MX-1 STEP SK
300  FOR YE=IB TO MX-XE STEP SK
310  AX=XE+YE-IB:AY=YE-IB:GOSUB 370:D1=D
320  AX=XE+YE+IB:AY=YE+IB:GOSUB 370:D2=D
330 AX=XE+YE:AY=YE:D=(D1+D2)/2+RND(1)*L/2-L/4:GOSUB 420
340  NEXT YE
350 NEXT XE:RETURN
360 REM *** return data from array ***
370 IF AY>MY THEN 390
380 BY=AY:BX=AX:GOTO 400
390 BY=MX+1-AY:BX=MX-AX
400 D=D(BX,BY):RETURN
410 REM *** put data in array ***
420 IF AY>MY THEN 440
430 BY=AY:BX=AX:GOTO 450
440 BY=MX+1-AY:BX=MX-AX
450 D(BX,BY)=D:RETURN
460 REM *** put in sea level here ***
470 IF XO<>-999 THEN 500
480 IF ZZ<0 THEN GOSUB 1070:Z2=ZZ:ZZ=0:GOTO 620
490 GOSUB 1090:GOTO 610
500 IF Z2>0 AND ZZ>0 THEN 610
510 IF Z2<0 AND ZZ<0 THEN Z2=ZZ:ZZ=0:GOTO 620
520 W3=ZZ/(ZZ-Z2):X3=(X2-XX)*W3+XX:Y3=(Y2-YY)*W3+YY:Z3=0
530 ZT=ZZ:YT=YY:XT=XX
540 IF ZZ>0 THEN 590
550 REM *** going into water ***
560 ZZ=Z3:YY=Y3:XX=X3:GOSUB 950
570 GOSUB 1070:ZZ=0:YY=YT:XX=XT:Z2=ZT:GOTO 620
580 REM *** coming up out of water ***
590 ZZ=Z3:YY=Y3:XX=X3:GOSUB 950
600 GOSUB 1090:ZZ=ZT:YY=YT:XX=XT
```



```
610 Z2=ZZ
620 X2=XX:Y2=YY:RETURN
630 REM *** display here ***
640 GOSUB 1110:REM *** set up plotting device or screen ***
650 XS=.04:YS=.04:ZS=.04:REM *** scaling factors ***
660 FOR AX=0 TO MX:XO=-999:FOR AY=0 TO AX
670 GOSUB 370:ZZ=D:YY=AY/MX*10000:XX=AX/MX*10000-YY/2
680 GOSUB 940:NEXT AY:NEXT AX
690 FOR AY=0 TO MX:XO=-999:FOR AX=AY TO MX
700 GOSUB 370:ZZ=D:YY=AY/MX*10000:XX=AX/MX*10000-YY/2
710 GOSUB 940:NEXT AX:NEXT AY
720 FOR EX=0 TO MX:XO=-999:FOR EY=0 TO MX-EX
730 AX=EX+EY:AY=EY:GOSUB 370:ZZ=D:YY=AY/MX*10000
740 XX=AX/MX*10000-YY/2:GOSUB 940:NEXT EY:NEXT EX
750 GOTO 1130:REM *** done plotting, goto end loop ***
760 REM *** rotate ***
770 IF XX<>0 THEN 800
780 IF YY<=0 THEN RA=-PI/2:GOTO 820
790 RA=PI/2:GOTO 820
800 RA=ATN(YY/XX)
810 IF XX<0 THEN RA=RA+PI
820 R1=RA+RH:RD=SQR(XX*XX+YY*YY)
830 XX=RD*COS(R1):YY=RD*SIN(R1)
840 RETURN
850 REM *** tilt down ***
860 RD=SQR(ZZ*ZZ+XX*XX)
870 IF XX=0 THEN RA=PI/2:GOTO 900
880 RA=ATN(ZZ/XX)
890 IF XX<0 THEN RA=RA+PI
900 R1=RA-VT
910 XX=RD*COS(R1)+XX:ZZ=RD*SIN(R1)
920 RETURN
930 REM *** move or plot to (xp,yp) ***
940 GOSUB 470
950 XX=XX*XG:YY=YY*YG:ZZ=ZZ*ZG
960 GOSUB 770:REM *** rotate ***
970 GOSUB 860:REM *** tilt up ***
980 IF XO=-999 THEN PR$="M" ELSE PR$="D"
990 XP=INT(YY)+CX:YP=INT(ZZ)
1000 GOSUB 1030
1010 RETURN
1020 REM *** plot line here ***
1030 XP=XP*1.1:YP=80-YP:IF PR$="M" OR F1=1 THEN X8=XP:Y8=YP
1040 LINE (X8,Y8)-(XP,YP):X8=XP:Y8=YP:XO=XP
1050 RETURN
1060 REM *** switch color to sea color ***
1070 F1=1:RETURN
1080 REM *** switch to land color ***
1090 F1=0:RETURN
1100 REM *** set up plotting device or screen ***
1110 CLS:RETURN
1120 REM *** end loop ***
1130 A$=INKEY$:IF A$="" THEN 1130
1140 END
```

Listing 3. Apple II version.

```
20  DIM D(64,32)
30  INPUT "NUMBER OF LEVELS";LE
40 DS = 2: FOR N = 1 TO LE:DS = D
    S + 2 ^ (N - 1): NEXT N
50 MX = DS - 1:MY = MX / 2:PI = 3
    .1416:RH = PI * 30 / 180:VT =
    RH * 1.2
60  FOR N = 1 TO LE:L = 10000 / 1
    .8 ^ N
70  PRINT "WORKING ON LEVEL";N
80 IB = MX / 2 ^ N:SK = IB * 2
90  GOSUB 150: REM  *** ASSIGN HE
    IGHTS ALONG X IN ARRAY ***
100  GOSUB 220: REM  *** ASSIGN H
    EIGHTS ALONG Y IN ARRAY ***
110  GOSUB 290: REM  *** ASSIGN H
    EIGHTS ALONG DIAG. IN ARRAY
    ***
120  NEXT N
130  GOTO 640: REM  *** DRAW ***
140  REM  * HEIGHTS ALONG X *
150  FOR YE = 0 TO MX - 1 STEP SK
160  FOR XE = IB + YE TO MX STEP
    SK
170 AX = XE - IB:AY = YE: GOSUB 3
    70:D1 = D:AX = XE + IB: GOSUB
    370:D2 = D
180 D = (D1 + D2) / 2 +  RND (1) *
    L / 2 - L / 4:AX = XE:AY = Y
    E: GOSUB 420
190  NEXT XE
200  NEXT YE: RETURN
210  REM  * HEIGHTS ALONG Y *
220  FOR XE = MX TO 1 STEP  - SK
230  FOR YE = IB TO XE STEP SK
240 AX = XE:AY = YE + IB: GOSUB 3
    70:D1 = D:AY = YE - IB: GOSUB
    370:D2 = D
250 D = (D1 + D2) / 2 +  RND (1) *
    L / 2 - L / 4:AX = XE:AY = Y
    E: GOSUB 420
260  NEXT YE
270  NEXT XE: RETURN
280  REM  * HEIGHTS ALONG DIAG. *

290  FOR XE = 0 TO MX - 1 STEP SK

300  FOR YE = IB TO MX - XE STEP
    SK
310 AX = XE + YE - IB:AY = YE - I
    B: GOSUB 370:D1 = D
320 AX = XE + YE + IB:AY = YE + I
    B: GOSUB 370:D2 = D
330 AX = XE + YE:AY = YE:D = (D1 +
    D2) / 2 +  RND (1) * L / 2 -
    L / 4: GOSUB 420
340  NEXT YE
350  NEXT XE: RETURN
360  REM  *** RETURN DATA FROM AR
    RAY ***
370  IF AY > MY THEN 390
380 BY = AY:BX = AX: GOTO 400
390 BY = MX + 1 - AY:BX = MX - AX

400 D = D(BX,BY): RETURN
410  REM  *** PUT DATA INTO ARRAY
     ***
420  IF AY > MY THEN 440
430 BY = AY:BX = AX: GOTO 450
440 BY = MX + 1 - AY:BX = MX - AX

450 D(BX,BY) = D: RETURN
460  REM  *** PUT IN SEA LEVEL HE
    RE ***
470  IF XO <  >  - 999 THEN 500
480  IF ZZ < 0 THEN  GOSUB 1070:Z
    2 = ZZ:ZZ = 0: GOTO 620
490  GOSUB 1090: GOTO 610
500  IF Z2 > 0 AND ZZ > 0
    THEN 610
510  IF Z2 < 0 AND ZZ < 0 THEN Z2
     = ZZ:ZZ = 0: GOTO 620
520 W3 = ZZ / (ZZ - Z2):X3 = (X2 -
    XX) * W3 + XX:Y3 = (Y2 - YY)
     * W3 + YY:Z3 = 0
530 ZT = ZZ:YT = YY:XT = XX
540  IF ZZ > 0 THEN 590
550  REM  *** GOING INTO WATER **
    *
560 ZZ = Z3:YY = Y3:XX = X3: GOSUB
    950
570  GOSUB 1070:ZZ = 0:YY = YT:XX
     = XT:Z2 = ZT: GOTO 620
580  REM  *** COMING UP OUT OF WA
    TER ***
590 ZZ = Z3:YY = Y3:XX = X3: GOSUB
    950
600  GOSUB 1090:ZZ = ZT:YY = YT:X
    X = XT
610 Z2 = ZZ
620 X2 = XX:Y2 = YY: RETURN
630  REM  **** DISPLAY HERE ****
640  GOSUB 1110: REM  *** SET UP
    PLOTTING DEVICE OR SCREEN **
    *
650 XS = .04:YS = .04:ZS = .04: REM
     **** SCALING FACTORS ****
660  FOR AX = 0 TO MX:XO =  - 999
    : FOR AY = 0 TO AX
670  GOSUB 370:ZZ = D:YY = AY / M
    X * 10000:XX = AX / MX * 100
    00 - YY / 2
680  GOSUB 940: NEXT AY: NEXT AX
690  FOR AY = 0 TO MX:XO =  - 999
    : FOR AX = AY TO MX
700  GOSUB 370:ZZ = D:YY = AY / M
    X * 10000:XX = AX / MX * 100
    00 - YY / 2
710  GOSUB 940: NEXT AX: NEXT AY
720  FOR EX = 0 TO MX:XO =  - 999
    : FOR EY = 0 TO MX - EX
730 AX = EX + EY:AY = EY: GOSUB 3
    70:ZZ = D:YY = AY / MX * 100
    00
740 XX = AX / MX * 10000 - YY / 2
    : GOSUB 940:: NEXT EY: NEXT
    EX
750  GOTO 1130: REM  *** DONE PLO
    TTING, GOTO END LOOP ***
760  REM  *** ROTATE ***
770  IF XX <  > 0 THEN 800
780  IF YY <  = 0 THEN RA =  - PI
     / 2: GOTO 820
790 RA = PI / 2: GOTO 820
800 RA =  ATN (YY / XX)
810  IF XX < 0 THEN RA = RA + PI
820 R1 = RA + RH:RD =  SQR (XX *
    XX + YY * YY)
830 XX = RD *  COS (R1):YY = RD *
     SIN (R1)
840  RETURN
850  REM  *** TILT DOWN ***
860 RD =  SQR (ZZ * ZZ + XX * XX)

870  IF XX = 0 THEN RA = PI /
     2: GOTO 900
880 RA =  ATN (ZZ / XX)
890  IF XX < 0 THEN RA = RA + PI
900 R1 = RA - VT
910 XX = RD *  COS (R1) + XX:ZZ =
    RD *  SIN (R1)
920  RETURN
930  REM  *** MOVE OR PLOT TO (XP
    ,YP) ***
940  GOSUB 470
950 XX = XX * XS:YY = YY * YS:ZZ =
    ZZ * ZS
960  GOSUB 770: REM  *** ROTATE *
    **
970  GOSUB 860: REM  *** TILT UP
    ***
980  IF XO =  - 999 THEN PR$ = "M
    "
985  IF XO <  >  - 999 THEN PR$ =
    "D"
990 XP =  INT (YY) + CX:YP =  INT
    (ZZ)
1000  GOSUB 1030
1010  RETURN
1020  REM  *** PLOT LINE HERE ***

1030 XP = XP * 0.625:YP = 33.14 -
    0.663 * YP
1040  IF PR$ = "M" THEN X8 = XP:Y
    8 = YP:XO = X
1045  IF Y8 > 179 OR Y8 < 0 OR YP
    > 179 OR YP < 0 THEN  RETURN

1050  HPLOT X8,Y8 TO XP,YP:X8 = X
    P:Y8 = YP: RETURN
1060  REM  *** SWITCH TO SEA COLO
    R ***
1070  HCOLOR= 6: RETURN
1080  REM  *** SWITCH TO LAND COL
    OR ***
1090  HCOLOR= 7: RETURN
1100  *  *  * SETUP PLOT TINGDEVI
    CE OR SCREEN *  *  *
1110  HGR2 : RETURN
1120  REM  *** END LOOP ***
1130  INPUT A$
1140  TEXT : END
```



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TRS-80 MODEL I, III

Each Kit comes complete with eight MM5290 (UPD416/4116) 16K Dynamic RAMs and documentation for conversion. Model 1: 16K equipped with Expansion Interface can be expanded to 48K with 2 Kits. Model III: Can be expanded from 16K to 48K using 2 Kits. Each Kit will expand computer by 16K increments.

TRS-16K3 200ns (Model III). **$6.29**
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Easy to install Kit comes complete with 8 each 4164N-20 (200ns) 64K Dynamic RAMs and documentation for conversion. Converts TRS-80 Color Computers with D, E, ET, F and NC circuit boards to 32K. Also converts TRS-80 Color Computer II to 64K. Flex DOS or OS-9 required to utilize full 64K RAM on all computers.

TRS-64K-2. . . . . . **$17.95**

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TRS-64K-2. . . . . . **$17.95**
(Converts the Model IV from 16K to 64K or will expand the Model 4P from 64K to 128K)

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(8 - 4164's with PAL Chip to expand from 64K to 128K)

• TRS-80 Model 100* • NEC • Olivetti
***ALSO COMPATIBLE WITH NEC PC-8201A AND OLIVETTI M10**

Easy to install module plugs right into the socket increasing memory in 8K increments. Complete with module and documentation for conversion.

M1008K (TRS-80 Model 100 Expansion). **$49.95**
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Intelligent 300/1200 Baud Modem with Real Time Clock/Calendar

The ProModem™ is a Bell 212A (300/1200 baud) intelligent stand-alone modem • Full featured expandable modem • Standard features include Auto Answer and Auto Dial, Help Commands, Programmable Intelligent Dialing, Touch Tone™ & Pulse Dialing and More • Hayes command set compatible plus an additional extended command set • Shown w/alphanumeric display option.

PM1200 RS-232 Stand-Alone Unit. **$319.95**

OPTIONS FOR ProModem 1200

PM-COM (ProCom Communication Software). **$79.95**
Please specify Operating System
PM-OP (Options Processor). **$79.95**
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PMO-32K (Options Processor Memory – 32K). . . . . **$ 9.00**
PMO-64K (Options Processor Memory – 64K). **$18.00**
PM-ALP (Alphanumeric Display). **$79.95**
(Incl. Options Processor, 64K Memory and Alphanumeric Display). **$169.95**
PM-Special

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Eliminates voltage spikes and EMI-RFI noise before it can damage your equipment or cause data loss. 6-month warranty. Power dissipation (100 microseconds): 2,000,000 watts

PART NO.	DESCRIPTION	PRICE
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Protect your computer from black-outs, brown-outs, power surges and line noise. PTI's PC200 is designed for PCs with floppy disk storage, the XT300 for hard disk storage and the AT800 for multi-user systems. A typical compatible PC for each of these standbys will be supported for 15 to 25 minutes after power is lost. Weight (PC200: 27 lbs.) – (XT300: 43 lbs.) – (AT500: 65 lbs.) – (AT800: 83 lbs.)

PC200 (200 Watt Rating). **$299.95**
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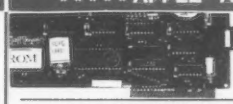
AT500 (500 Watt Rating). **$699.95**
AT800 (800 Watt Rating). **$799.95**

★★★★★ APPLE® Accessories ★★★★★



APPLE* Compatible CARDS

ASSC-P
Key: a = Apple II or II+ b = Apple IIe

16K RAM Card (Language Card)

The ARC-16K RAM Card allows the Apple* II and II+ computers to expand from 48K to 64K. Complete with instructions. Key: (a)

ARC-16K. **$39.95**

Z-80 CP/M Card

The AZ80-1 is Soft-card compatible. Used with CP/M related programs. Software not included. Key: (a,b)

AZ80-1. . . . . . **$49.95**

EPROM Burner Card

The AEB-2 allows user to program and work with standard EPROMs (2716, 2732 & 2764). Easy to use, on-board firmware. Menu contains the following options: Write, Read, Copy, Compare, Blank-Check and Monitor. Complete with instructions. Key: (a,b)

AEB-2. . . . . . **$69.95**

80-Column Card w/Soft Switch

The A80-C is an 80-column card designed for the Apple* II and II+ computers. The card is equipped with a soft switch which allows easy hookup for any monitor. The A80-C also features inverse video capabilities. This card is similar to the Videx*** 80 column card. Complete with instructions. Key: (a)

A80-C. **$74.95**

Super Serial Card

The ASSC-P is a serial card with a printer mode. It generates standard RS-232C signals and is similar to the Apple* Super Serial Card. Complete with instructions. Key: (a,b)

ASSC-P. **$99.95**

Parallel Card w/64K Buffer

The APC-64K is a parallel card with a 64K buffer and graphic dump capabilities. Complete with instructions. Key: (a,b)

APC-64K. **$129.95**

80-Column/64K RAM Card

Extended 80-Column/64K RAM Card expands memory by 64K to give 128K when used with programs like VisiCalc™. Complete with instructions. Key: (b)

JE864. . . . . . **$79.95**

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APPLE™ Compatible 5¼" Half-Height Disk Drive

Reduced Pricing!

• Uses Chinon Pinch-type mechanics • 143K formatted storage • 35 tracks • Super quiet • Works with Apple Controllers or other compatibles (ACC-1) (left) • Complete with connector – just plug into your controller • Size: 5¼"W x 1⅝"H x 8"D • Wt. 4 lbs. Key: (a,b)

ADD-12. . . . . . **$159.95**

APPLE™ Compatible 5¼" Disk Drive & Controller Card

• Uses Shugart SA390 mechanics • 143K formatted storage • Color matches Apple Computer • Works with Apple Controller or other Apple-compatible controllers (ACC-1) • Complete with connector – just plug into your disk controller card • 35 tracks • Size: 6"W x 7"H x 8-9/16"D • Wt. 4¼ lbs. Key: (a,b)

ADD-514 (Disk Drive). **$149.95**
ACC-1 (Controller Card). . . . . **$ 49.95**

APPLE™ IIc Compatible 5¼" Half-Height Disk Drive

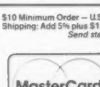
• Same specs as ADD-12 (left) except no controller necessary

ADD-IIc. **$169.95**

Additional Apple* Compatible Products

APF-1	Cooling Fan with surge protection • Key: (a,b).	$ 39.95
JE614	Numeric/Aux. Keypad – 23 accessible functions • Key: (b). . . .	$ 49.95
EAEC-1	Expanded Apple Enclosure Case only • Key: (a).	$ 59.95
KHP4007	Switching Power Supply • Key: (a).	$ 59.95
KB-A68	68-Key Apple Keyboard only • Key: (a).	$ 79.95
MON-12G	12" Green Monitor with swivel stand • Key: (a, b &/lc).	$ 79.95
JE520AP	Voice Synthesizer – Plug-in, User Ready • Key: (a,b).	$119.95
KB-EA1	Apple Keyboard and Case • Key: (a).	$134.95
PM1200A	Prometheus Internal Modem – 2 cards • Key: (a,b).	$299.95
PM1200M	Prometheus Macintosh Ext. Modem • Key: (Macintosh).	$369.95

General Application Power Supplies



Power/Mate Corp. REGULATED POWER SUPPLY

• Input: 105-125/210-250VAC @ 47-63Hz • Line regulation: ±0.05% • Three mounting surfaces • Overvoltage protection • UL recognized • CSA certified

Part No.	Output	Size	Weight	Price
EMA5/6B	5V@3A/6V@2.5A	4⅞"L x 4"W x 2⅛"H	2lbs.	$29.95
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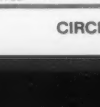
KEPCO/TDK 4-OUTPUT SWITCHING POWER SUPPLY

• Ideal for disk drive needs of CRT terminals, microcomputers and video games • Input: 115/230VAC, 50/60Hz • Output: +5V @ 5A, +12V @ 1.8A, +12V @ 2A, –12V @ 0.5A • UL recognized • CSA certified • Size: 7¾"L x 6-3/16"W x 1⅝"H • Weight: 2 lbs.

MRM 174KF. **$49.95**



4-CHANNEL SWITCHING POWER SUPPLY

• Microprocessor, mini-computer, terminal, medical equipment and process control applications • Input: 90-130VAC, 47-440Hz • Output: +5VDC @ 5A, –5VDC @ 1A, +12VDC @ 1A, –12VDC @ 1A • Line regulations: ±0.2% • Ripple: 30mV p-p • Load regulation: ±1% • Overcurrent protection • Adj: 5V main output ±10% • Size: 6⅜"L x 1⅞"W x 4-15/16"H • Weight: 1½ lbs.

FCS-604A. **$69.95**

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6-Foot Serial Printer/Modem Cable

MMS-2206 (DB25 Male to DB25 Male). **$14.95**
MFS-2206 (DB25 Male to DB25 Female). **$15.25**

5-Foot Keyboard Extension Cable for IBM-PC and XT Computers

IBM-KEC. **$9.95**

MEMORY EXPANSION KITS

IBM PC, PC XT and Compatibles

The IBM64K Kit will increase memory in 64K byte increments. The Kit is simple to install – just insert the 9 - 64K RAM chips in the provided sockets and set the 2 groups of switches. Conversion documentation included.

IBM64K (Nine 200ns 64K RAMs). **$19.95**

IBM PC AT

Each kit comes complete with nine 128K dynamic RAMs and documentation for conversion.

IBM128K (Nine 250ns 128K RAMs). . . . **$133.95**

IBM PCXT Equivalent 130 Watt Power Supply

UPGRADE YOUR PC!

• Input: 110V @ 60Hz • Output: +5VDC @ 15A, –5VDC @ 0.5A, +12VDC @ 4.2A, –12VDC @ 0.5A • Plug compatible connectors • Fits into IBM PC • Weight: 6 lbs.

IBM-PS. **$159.95**

Prometheus Modems

The ProModem 1200B/BS is a 1200/300 baud modem card which plugs into IBM PC and XT. Provides a third serial Comport. Two versions available: 1200B (without software) and 1200BS (with software). The PM1200BS is supplied with powerful MITE communications software from Mycroft labs.

PM1200B (without Software). **$239.95**
PM1200BS (with MITE Software). **$274.95**

IBM Compatible! DISK DRIVES

Documentation Included

RFD480 (Remex 5¼" DS full-ht.). . . . . **$ 99.95**
FD55B (Teac 5¼" DS half-ht.). **$139.95**
SA455 (Shugart 5¼" DS half-ht.). **$139.95**
TM100-2 (Tandon 5¼" DS full-ht.). **$159.95**

5¼" DISK DRIVE ENCLOSURES

Complete with power supply, switch, power cord, fuseholder and connectors

DDE-1FH (Houses 1 full-ht. 5¼" drive). **$69.95**
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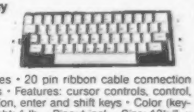
General Application Keyboards

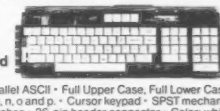
Mitsumi 54-Key Unencoded All-Purpose Keyboard



• SPST keyswitches • 20 pin ribbon cable connection • Low profile keys • Features: cursor controls, control, caps (lock), function, enter and shift keys • Color (keycaps): grey • Weight: 1 lb. • Pinout incl. • Size: 13⅛"L x 4¼"W x ¾"H

KB54. . . . . . **$14.95**

74-Key ASCII Cherry Keyboard



• 7-bit parallel ASCII • Full Upper Case, Full Lower Case except l, m, n, o and p. • Cursor keypad • SPST mechanical keyswitches • 26-pin header connector • Color: white • Size: 18"L x 6¾"W x 1¼"H • Spec included

KB8201. . . . . . *(1700 available).* **$29.95**

UV-EPROM ERASER

8 Chips - 21 Minutes

1 Chip - 15 Minutes

Erases all EPROMs. Erases up to 8 chips within 21 minutes (1 chip in 15 minutes). Maintains constant exposure distance of one inch. Special conductive foam liner eliminates static build-up. Built-in safety lock to prevent UV exposure. Compact – only 9.00"L x 3.70"W x 2.60"H. Complete with holding tray for 8 chips.

DE-4 UV-EPROM Eraser. **$74.95**
UVS-11EL Replacement Bulb. **$16.95**

APPLE CART

Beating Lotus to the punch, improving your chess, and an integrated package for the II/**Joseph Desposito**

As a square is to a cube and a circle to a sphere, so is the Apple IIe to the Mac. I'm not picking on the IIe here. You can substitute any other microcomputer in its place—even the IBM PC. The Mac might not be the greatest business machine on the market, but it *can* take you into another dimension.

I felt the full power of the Mac recently when two paths coincidentally crossed. I was given a book called *The Queen's Gambit* by Walter Tevis (author of *The Hustler*) and a copy of Hayden's *Sargon III* for the Mac (I already had a copy for the Apple II).

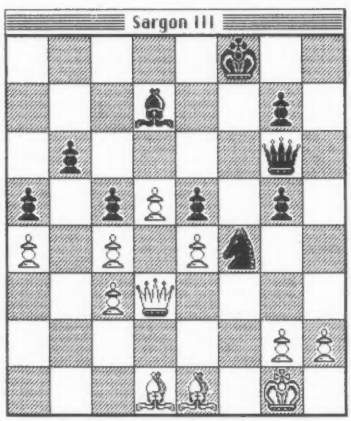
The book tells the story of a young girl, Beth Harmon, who is a chess prodigy. One of her talents is an ability to visualize the chessboard in her head. The book describes her as an 8-year old after she had played only a few games of chess: "That night she lay on her back in bed. She blinked and looked at the dark ceiling overhead and forced herself to see the chessboard with its green and white squares. Then she put the pieces on her home squares: rook, knight, bishop, queen, king, and the row of pawns in front of them. Then she moved white's king pawn up to the fourth row. She pushed black's up. She could do this! It was simple. She went on, beginning to play the game she had lost."

I began to play chess somewhat seriously in my early twenties and made a strong effort to learn the intricacies of the game. I bought many books on the subject including *Modern Chess Openings*. This book is the size of a calculus textbook and lists all the important openings that are used in chess competitions. I tried my best to get something out of it, but I just couldn't. I eventually became a fair player, achieving a United States Chess Federation rating of 1420. But I knew that I hadn't come close to mastering the game, hadn't penetrated chess to its core.

Now I was reading about Beth Harmon who "held *Modern Chess Openings* under her desk (in class)...and went through variations one at a time, playing them out in her head." Although Beth is a fictional character, I knew there had to be some truth in the story of her chess talents. And I knew that I had missed something important 15 or so years ago when I tried to learn the game.

Then along came *Sargon III* for the Macintosh with its superb graphics, and I thought to myself: I might not have the "talent" to visualize chess moves in my head, but here is a machine that can do it for me. It can compensate for my weakness. Let me explain.

One of the features of *Sargon III* is its "replay" mode. You can play a game or a sequence of moves, save the game or moves to disk, and then replay them on the screen as many times as you want. The board is reset to the beginning, and the moves continue automatically. A game can be replayed as many times as is needed for it to sink in.



Sargon III displays a crucial position from the 5th game of the 1972 World Championship between Bobby Fischer and Boris Spassky.

The only problem now is that it will take a great deal of time for me to input *MCO* into the computer. But that is really not a long term problem. I'm sure that someone will eventually sell *MCO* on disk so that you can do some serious visualizing without the drudgery of manually inputting thousands of moves into the Mac.

One question: Has *Sargon III* on the Mac improved my game? It's too early to tell. But I am determined to penetrate a little deeper into the game of chess this time around with the help of the Mac. And I didn't even mention that I now have an opponent who is always willing to beat the pants off me any time that I have the urge to play. It seems that the lowest level on the Mac version of *Sargon* is about five times as powerful as the lowest level on the Apple II version due to the increased speed of the 68000 chip in the Mac. I beat the Apple II version a few times but haven't come close with the Mac.

If you'd like to try entering a new dimension, *Sargon III* is available for a suggested retail price of $49.95 and runs on a 128K, one drive Mac.

Integrated Software for the Macintosh

With the bombshell announcement by the Lotus Development Corporation that its *Jazz* integrated software product would be delayed for another two months, a couple of companies may have gained an opportunity to establish their own integrated products. First to come to the market was Hayden's *Ensemble* followed closely by Haba Systems *Quartet*.

The *Ensemble* approach to integration is through a database environment. The database is set up in vintage Macintosh fashion. You begin by creating a form in which you "drag" the mouse to open rectangular areas for fields and field names. The form can even include an area for a graphics entry, although graphics are created through *MacPaint*.

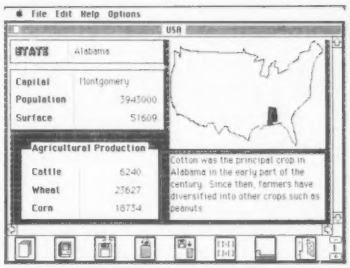
Lest I give you the wrong idea, *Ensemble* can create graphs from the data that you input into the database. The graphics that I'm speaking about are pictures that are saved along with the text and numbers that you input into a form (record). So with *Ensemble, MacPaint*, and a digitizer, the U.S. Post Office could conceivably keep a database of the hundred or thousand "Most Wanted" criminals complete with their digitized photos.

Ensemble does let you create small spreadsheets of about 30 columns. These can be used to create an incredible selection for 2-D and 3-D graphs quickly and

easily. And it also will let you write text so that you can have a complete arsenal of weapons at your command when it's time to hand in the monthly report.

Ensemble is a relational database that will let you link up to three files. You can do calculations on the data, but *Ensemble* lacks its own language. Some of its other features are mail merge and labels.

Like most Mac software, *Ensemble* is slow and protected and supports only the Imagewriter. However, I did get it to work with an Epson FX-80 by modifying it with *Epstart*. But I couldn't make a backup copy that didn't need the "key" —the *Ensemble* Master disk.



A typical Ensemble record includes a MacPaint drawing.

File Edit Data Options Range Format Sheet
EXERCISE 4
D1:D18
500 Jail Way
A
B
C
D
1 Last Updated: 5/28/1985 Customer Data Base
2
3
4 First Name Last Name Company Address
5 Blake Carrington Denver-Carrington 100 Carrington Terr
6 Crystal Carrington Carrington Mansion Carrington Way
7 Wendy Darling Young Mothers Club 10 Kensington Gardi
8 Old Deuteronomy Cats Union 50 High St.
9 T.S. Eliot Cats Productions 100 Broadway
10 J.R. Ewing Ewing Oil Ewing Towers
11 Roy Hobbs The Knights Knights Field
12 James Kirk U.F. Space Projects Starship Enterprise
13 Stanley Kowalski Laborers Union 100 Desire St.
14 Mr. Mistofeles Cat Magicians' Union Back Alley Way
15 Wolfgang Mozart Musician's Union Grand Way
16 Peter Pan Lost Boys Union Below Ground
17 Mrs. Robinson Disconiented Women's Union 7000 Canon Dr.
18 Kate Soffel Discontented Women's Union

In the Quartet database, records are rows and fields are columns.

Quartet from Haba Systems is in the tradition of the integrated products some people have come to worship. It uses the spreadsheet as its source of strength and delivers a product with some punch. When I first saw an integrated product from Haba Systems I was immediately suspicious of its quality. Not that Haba doesn't produce fine products, it is just that I suspected they had bitten off more than they could chew, trying to beat Lotus to market with an integrated product. But Haba did not write this software—they are just marketing it. The software development team goes by the name MBA Software.

The product is an interesting one. It doesn't offer the vast spreadsheet of *Lotus 1-2-3*, but it does have a cell matrix of 62 x 999. And it appears to be lightning fast. (Please, this is not a full review since I had the product for only a day before I wrote this.) Compared to *Multiplan* on the Mac, it does some things better and some worse. It has a GOTO cell feature for those times when you don't want to guess with the scroll bar, but it also requires you to type an apostrophe whenever you type a label. But *Multiplan* is not integrated, and that's where *Quartet* has a big edge.

Quartet can draw pie, bar, and line graphs of up to four sets of data. However, this graphing function is not nearly as sophisticated nor as simple to use as the one from *Ensemble*. It has a text capability, too. Whenever you want to insert text into the spreadsheet, you just designate an area for it. With the built-in editing capabilities of the Mac, you wind up with a fair word processor. The final integrated feature is a database capability, which allows you to set up records in rows, and fields in columns. Then you can manipulate the data through creative sorting.

Quartet supports Apple's Imagewriter and LaserWriter, and can be used with the Mac numeric keypad. I was able to modify the disk for use with an Epson printer. The disk is copy protected, so I couldn't make a backup copy that didn't need the "key."

Quartet comes with one disk—the master disk, which does contain some sample files. The program runs on either a 128K or 512K Mac with one or two drives or a hard disk. Suggested retail price is $199.

Of the two products, it appears that *Ensemble* has more power, but *Quartet* has the features that everyone is looking for.

SuperCalc 3a for the Apple II

Although the Apple II was the first microcomputer to have a spreadsheet, it was ignored by companies such as Lotus, which produced more powerful integrated spreadsheets for the IBM PC. Well, it may be too late but it's certainly not too little—*SuperCalc3a* from Sorcim is now available for the Apple IIe and IIc computers. It is a dandy package with all the trimmings.

Now Apple II users can purchase a powerful ProDOS-based spreadsheet that integrates graphs and database management functions. The spreadsheet offers a matrix of 254 rows and 63 columns. There are numerous formatting commands, built-in functions, and pointing capability.

Eight graph types are available: pie and exploded pie, bar and stacked bar, area, line, hi-lo-open-close, and x-y. Graphics can be viewed on the screen in up to 16 colors, printed, or plotted.

The database has a capacity similar to the spreadsheet. It has space for up to 253 records with 65 fields per record. You can sort the database using primary and secondary keys.

Unlike the products for the Macintosh, *SuperCalc3a* supports 15 printers and six plotters. Additionally, *SuperCalc3a* includes Sideways, a program that allows you to print wide reports sideways on your printer.

You know that Sorcim has been in the game for a long time, because they have also included a send/receive utility that lets you transfer *SuperCalc* files to and from an IBM PC. The program also reads *VisiCalc* and *AppleWorks* data and logic files, and reads and writes DIF files.

SuperCalc3a comes with three disks, Program, Graph, and Tools, which are not copy protected. It requires 128K RAM and one disk drive, and runs in either 40- or 80-column mode. The program has a suggested retail price of $195.

This program could have been a blockbuster a few years ago. It will be interesting to see how well an exceptional program like this does in today's market. ■

Firms Mentioned In This Column

Hayden Software Co.
600 Suffolk St.
Lowell, MA 01853
(617) 937-0200

Haba Systems, Inc.
15154 Stagg St.
Van Nuys, CA 91405
(815) 901-8828

Sorcim Corp.
2310 Lundy Ave.
San Jose, CA 95131
(408) 942-1727

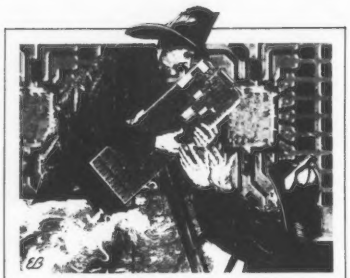
IBM IMAGES

Lower prices, new XT configurations, new buying strategies, and PCjr withdrawal/**Will Fastie**

To say the least, I am stunned. I thought that IBM would go to the ends of the earth rather than risk the embarrassment of having a product fail, especially one for the high visibility home or educational market. But that, indeed, is what IBM has done. The PCjr is no more; frankly, I am saddened. I seem to be alone among my editorial peers when I say this: PCjr was not a bad computer. It is clear in retrospect that IBM made a few early mistakes that cost it dearly. The keyboard was one (IBM fixed it, but initial sales were slowed by the error) and the price was another. Had IBM offered a more competitive price to begin with, there might have been more interest. Of course, the biggest problem may have been that IBM missed Christmas '83 because of late delivery and thus missed a good, early market opportunity.

In making the announcement, IBM said that the machine would continue to be supported. I think you can be sure that IBM will provide service, at least for some number of years; that is simply sound business practice. Software additions are likely, but that is not a problem considering that PCjr is a full-fledged member of the PC family and thus will run much of the software for its bigger siblings. Hardware additions are unlikely, in my opinion, because an installed base of 250,000 machines is not large enough to interest IBM, whose attention will be focused on the four million PCs sold to date. I might also suggest that IBM will continue to make PCjr available through OEM channels. I know of one such deal in the works: the buyer will use the basic components of the machine as the controlling computer in their product. They are looking at a quantity in excess of 10,000 units. Given that the machine would be sold direct in such cases, IBM can lower the price and still collect a tidy profit.

There is always a silver lining, the old saying goes. In this case, it may be that the price of the remaining PCjrs in the retail channels will hit rock bottom and thus present an attractive buying opportunity. For those looking for a cheap, IBM-compatible computer, now just might be the right time to think jr. A word of warning to owners: consider buying add-on equipment soon. Because the market is suddenly so limited, and because not all PCjr owners will expand the machine, add-ons will become less attractive as a business, and that means some of the companies who have products today will discontinue them tomorrow. A few smaller companies will be able to make some money building expansion hardware for a while, however, so all is not lost if you own the little guy.



What may really be happening is a fire sale on all 8088-based products.

Caveat Emptor!

The second big piece of news from IBM is that prices for the PC and XT have been reduced, and the XT has become available in two new models. The two new XTs are not really new: in a fairly standard marketing adjustment, IBM is offering two new *configurations* of the same computer. The first model is an XT with one floppy but without the hard disk, and the second model has two floppies and no hard disk. You might ask how that makes the machines XTs; after all, XTs are supposed to have hard disks, aren't they? Actually, the answer to that question is no. What makes an XT is its system board (8 slots, XT BIOS chips) and its power supply (130 watts). Each of these new machines is so equipped. The hard disk controller and the disk drive itself have been lowered in price and are available as products, not just as spare parts. The prices for all of these are shown in Table 1, along with new prices for the PC Portable and the PC. Some price adjustments are not shown: other IBM products based on the PC or XT (like the 3270-PC) were also reduced.

These price reductions are interesting. I suggest that IBM is phasing out the PC and will soon sell only the XT. This allows them to build only one 8088 system board instead of the two they now build (the PC Portable already uses the XT system board). The hard-diskless-XT is also preferable to the PC because with more slots and a bigger power supply, just about any kind of expansion is possible. I'd much rather have an XT-based system at home than the PC. I could still use my Kamerman disk and I'd have empty slots again for adding other boards, including my game port (which had to come out when I bought the Kamerman). Many businesses are also feeling the slot crunch by now, and IBM needs to be sure that additional enhancement products, such as internal backup tapes, network boards, or other IBM communications products, can be added.

IBM may also be responding to having painted themselves into a corner. Some recent add-in board products (such as the Professional Graphics Controller) have required two adjacent slots for a rigidly connected two-board combo. Slot spacing in the basic PC remains at 1 inch, but in every other machine, as well as expansion boxes, the spacing is .8 inches. Something that might require two boards (given IBM's tendency to be conservative and have wide appeal) might be an IBM-supplied accelerator card, a device that replaces the 8088 processor with a faster chip and thus delivers AT-like performance in a PC.

Fire Sale or Market Strategy?

What may really be happening, however, is a fire sale on all 8088-based products. This theory is widely held because most analysts believe that IBM's

new machine is going to have the 80286 chip and that the 8088 is going to be phased out. The general idea is that an 8088 is not powerful enough for the future.

As usual, I don't agree. There are a lot of PCs and XTs out there doing useful, productive work in a timely and efficient manner. Not every application needs a huge disk or gobs of memory. It is silly to think that every user of spreadsheets needs a 640K machine. (On a disk-based system, spreadsheets larger than a disk aren't possible anyway.) As for performance, a PC may not be the fastest machine around but it is usually more than adequate.

More memory, disk capacity, and performance need to be added as the individual system user tries to become more productive. A financial planner may be operating at the limit of main memory with spreadsheets and probably can benefit from the dramatic performance increase an AT or other newer desktop can offer. A clerk maintaining a large file of information may benefit from a larger hard disk and improved data transfer characteristics. But what about all those machines doing nothing but word processing? While a bigger disk or faster execution might make some difference, a PC nevertheless performs adequately.

Often, a PC is overkill for many applications. Consider the fact that the Apple II continues to sell well even though it operates at about half the speed of the PC. It may be an oversimplification, but I believe that the Apple II is just fine for loads of applications. If that's the case, and the PC has greater performance, then the PC in its current form is even finer. Better yet, the falling prices of the PC family and the greater expandability of the XT models make the machine even more attractive than before. Why should the availability of the more powerful AT, good as it is, affect the judgement of either IBM or its customers? It shouldn't, and I don't think it will.

IBM is doing itself a favor by making the PC less attractive and directing attention to the XT. As the prices of the XT models continue to fall, I predict that XTs will hold their own. IBM may be thinking this way too: it is not their nature to have a fire sale, and the price of at least one PC model actually rose!

Are the Prices Better?

If it's great for IBM, is it great for you? After all, if IBM wants you to buy XTs, they should make it worth your while.

The base price of a 256K, 2 disk drive system is now $2,295, while a like XT is $2,570. The difference of $275 is a little more than the cost of an XT power supply ($215) minus the cost of the PC power supply ($200) plus the cost of the asynchronous adapter ($100), so the XT still represents a small premium ($115).

How about buying a slim XT and later upgrading with the fixed disk? The base 256K, single disk unit now costs $2,270. The upgrade requires the fixed disk adapter ($495), the fixed disk ($1,195), and the asynchronous port ($65) for a total of $4,025. The configured XT lists at $3,895, a $130 savings.

These differences are not meaningful at all, especially when considered in light of street prices, which typically represent discounts of from 10 to 20% off list. Further, I can't imagine many folks buying a $1,690 fixed disk subsystem when you can get so many complete subsystems for under $700, some of which even include a 20Mb disk instead of the more usual 10Mb. In that light, the new PC price of $2,295 plus a $695 fixed disk from a third party gives a total of $2,990; compare that to the XT price of $3,895 and you have to wonder. Buy a slim XT and upgrade and you'll save another $25!

My conclusions? For companies buying any of these machines on a regular basis in quantity, the price changes represent some savings worth considering. For the buyer of just a few systems, the prices haven't changed much, although the 12% drop in configured XTs is more significant. As for the PC versus XT decision, there is little financial impetus for the slim XT. The motivation for going XT will be twice the power supply and 1.5 extra slots.

For the home buyer, these price changes do not bring a PC within easy reach. Assuming the now-extinct pricing of the PCjr, the PC is at least $700 more expensive for a similar configuration. For the serious buyer, that may not be too much and it will buy more expandability and some additional performance over the PCjr.

My recommendation? Forget the PC. Go XT, sans hard disk. It's a better base upon which to build, no matter what options you choose next. ■

Table 1. IBM price changes.

Item	Memory Size	Number of Floppies	Fixed Disk Size (Mb)	Old Price	New Price	Reduction	%
PC	64	0		$1,265	$1,390	-125	- 9.88%
PC	64	2		2,240	2,115	125	5.58%
PC	256	2		2,420	2,295	125	5.17%
XT	128	1	10	4,275	3,775	500	11.70%
XT	256	1	10	4,395	3,895	500	11.38%
XT	256	1		new	2,270	n/a	n/a
XT	256	2		new	2,570	n/a	n/a
Portable	256	2		3,020	2,895	125	4.14%
Components							
Fixed disk, 10 Mb				1,395	1,195	200	14.34%
Fixed disk controller				590	495	95	16.10%
Fixed disk and controller				1,985	1,690	295	14.86%
PC expansion unit				2,880	2,585	295	10.24%
XT expansion unit				2,290	2,090	200	8.73%

Note: negative number in Reduction column indicates price *increase*.

TANDY GRAM

The C FOR statement clarified and Dotwriter 4.0/ **Jake Commander**

Well I put my foot in it didn't I! In my enthusiasm to compare C with Basic, I went a little too far, and my face is red this month. What happened was that when I compared the FOR statement in Basic with the for statement in C, I demonstrated a parallel between the languages that doesn't exist in quite the way I described. What I did wrong was to illustrate a for loop in C which was supposed to end when a specified condition became true. In fact, the opposite is true; a for loop executes in C *while* the specified condition is true and then terminates when it becomes false.

Please accept my apologies for that blunder. I'm only a human programmer, subject to the same Murphy's law faced by all programmers. The most curious aspect of my mistake is that when I wrote the example, I had already incorporated the for statement in my C compiler which worked exactly as per the book.

That's what you get for talking in C and thinking in Basic. The erroneous example I gave:

for(x=1;X==10;x=x+1)

should have read:

for(x=1;x<=10;x=x+1)

The second (correct) statement directs the for loop to continue while x is less than or equal to ten, thus cycling x from one to ten. The first statement taken literally directs the loop to execute while x is equal to ten which it can never be as it is initialized to one and never incremented, as the loop is never entered. Perhaps my blunder will make that point clearer to those of you still wary of C. As for myself, I'll never use a for loop again as long as I live.

I did receive some scolding mail on that subject which also attempted to convince me that some of my other examples were silly. As examples though, they were meant only to illustrate the ease with which I think a Basic programmer can learn C. They were not meant to be particularly elegant pieces of C programming. In particular in the above example, the x=x+1 (which is familiar enough to Basic programmers) can be written in C as x++, or x+=1 or as I chose to illustrate, x=x+1. In the context of that example, they would all increment x by one. So no more letters from C purists please. I'll try to convince Basic programmers in my own way, thank you.

As a final note on the subject of C, I recently noticed that Alcor Systems has a fully implemented C compiler for the Models 1/3/4 which they are selling for $89.95 (currently marked down from $250). This is a good price for a full C compiler. With any luck, I'll have a copy to review in this column soon.

In the meantime, if you can't wait, you can get Alcor Systems at 1132 Commerce, Richardson, TX 75081. Naturally you'll remember to tell them you heard it here won't you?

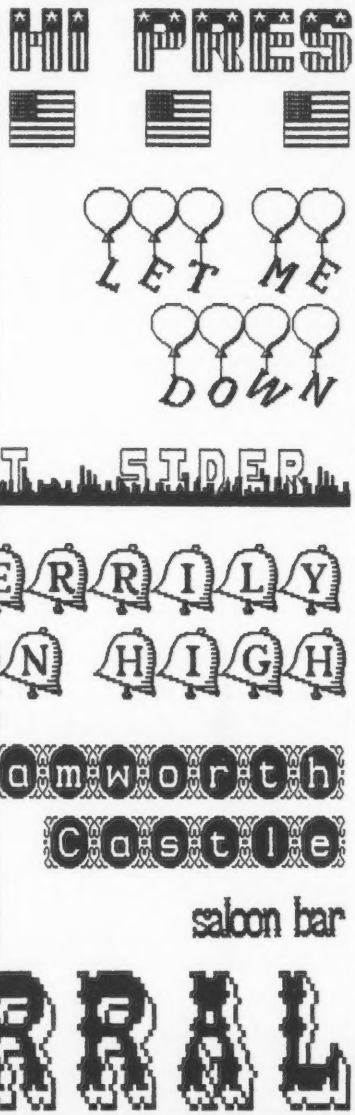
Dotwriter 4.0

Speaking of reviews, that's what the rest of this month's column is: a quick overview of *Dotwriter 4.0* for the Models 1/3/4/. This is published by Prosoft, Box 560, North Hollywood, CA 91603, a company that has been around for a long time by TRS-80 standards—they have seen quite a few other companies come and go over the last few years.

Prosoft has quite a few products for the Models 1, 3 and 4 which include a word processor *Allwrite* (which takes up where their previous *Newscript* left off) and a sideways printing utility for printing out frighteningly long spreadsheets. They also sell downloadable font disks for the Radio Shack DMP 2100P and the Epson LQ-1500 printers. (These fonts are separate from the fonts available with the *Dotwriter* package.)

A couple of years ago I had the opportunity to review *Dotwriter 3.0* and its sister utility, *GEAP*—graphics editor and programmer. It was a splendid package back then, and I'm pleased to see that not only did it stand

A sampling of Dotwriter 4.0 print styles shown actual size, from top to bottom: July 4, Circus, City, Bells, Cameo, Corral, and 3D Corral magnified 3 times.



the test of time but it has been substantially enhanced. These days, *Dotwriter* is written entirely in machine code (it used to be a Basic/machine code hybrid). The same is true for *GEAP* and both programs have new monikers. *Dotwriter 3.0* is now *Dotwriter 4.0*, and *GEAP* is TGEAP, now a part of the *Letterset Design System* (LDS) which lets you design your own graphics and typefaces.

If you hurry with the utmost haste, you can upgrade your old versions for quite reasonable prices. For first-time buyers, *Dotwriter 4.0* complete with 14 fonts is $79.95 for Models 1/3 and $99.95 for the Model 4. Extra font disks containing from three to 12 fonts are $24.95, and the *Letterset Design System* comes at $39.95.

If you buy *Dotwriter 4.0* as a first-time user, you are in for some tremendous fun; you can go absolutely bananas with character sets on your printer. What you get is a package that allows you to print out your word processing files using fonts which come on separate disks. If you have ever browsed through a Letraset manual and admired all those typefaces—the fancy, the slick, the austere, the chic, even the crazy ones—this is your chance to produce some stylized text with your own humble and previously untapped TRS-80. All you need is a disk-based Model 1, 3, or 4 and a printer capable of dot graphics. Each letterset disk is capable of supporting both 7-bit (Microline and Radio Shack DMP series) and 8-bit (Epson and C-Itoh) graphic printers.

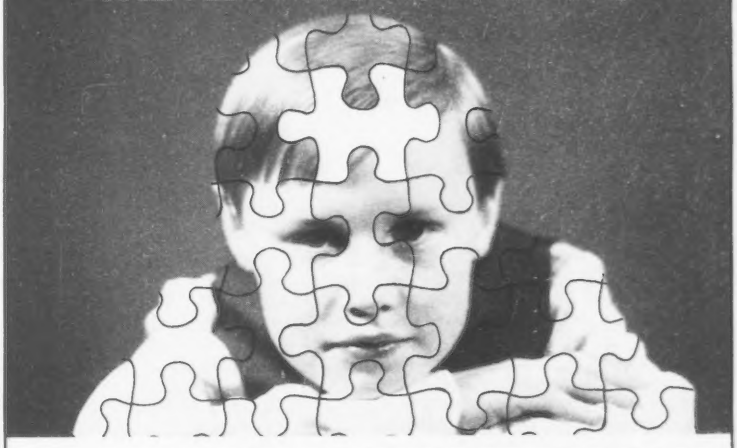
How would you like to choose from over 230 different typefaces? With up to 35 letterset disks, *Dotwriter 4.0* lets you do just that. Now when you decide to send a letter to the President, you can print it in Americana or July 4th and appear ultra-patriotic. A look at the examples will convince you that no president could fail to be impressed by such panache.

Not only does *Dotwriter 4.0* let you choose from many fonts, it lets you experiment with variations like double-width, double-strike, and emphasized printing. You can also change the magnification of characters or select proportional spacing. You can even do kerning (make the curly bit of a descender stretch under the preceding character for example.) In combination with the number of available fonts, the number of possible typestyle permutations becomes staggering. In fact, Prosoft has even found it necessary to print their own letterset reference catalog—just like a Letraset catalog—which by way of final proof was produced with *Dotwriter*.

It is a piece of cake to take advantage of all this textual flexibility. *Dotwriter* has a set of 65 commands which you simply embed in your text. You don't need a special word processor—your regular one will do. To invoke the *Dotwriter* commands, you simply precede the two letters representing each one with a dot. When *Dotwriter* is subsequently used to print out the text, it senses these commands and acts accordingly. For example, .BF CORRAL would tell *Dotwriter* to begin using a font with a filename of CORRAL, .CE ON would cause automatic centering of printed text.

Over two years ago, when I first reviewed this software, I decided *Dotwriter 3.0* was one of my favorite TRS-80 programs. A couple of years and a couple of hundred typefaces later, *Dotwriter 4.0* keeps that torch burning. ■

THE KEY PIECE IS THE MIND



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CIRCLE 146 ON READER SERVICE CARD

OUTPOST: ATARI

User group support, DOS 2.5, Scuttlebytes, a first impression of the 130XE, and a super font enhancement/**John J. Anderson**

Well, XEs are shipping in earnest now and STs are about to; it might soon be safe to posit that Atari is back on the track. One of the things I am happiest to see from the born-again folks this second time around is strong and serious user group support. After all these years, Atari has finally realized the importance of their user groups nation- and worldwide, and seems to be making an effort to connect with them.

I was most impressed to see that the ST series made its hands-on debut within selected user groups, and that Jack Tramiel took one to a meeting of the notoriously hard-nosed Boston Computer Society for a good natured roast. My old friend Neil Harris of *Atari Explorer* has made a superb effort to extend telecommunicative user support online and has made Atari's presence consistently felt both on the CompuServe Atari SIG and *Creative Computing* Online. After screaming myself hoarse years ago at the "old" Atari in this column and elsewhere, it is extremely gratifying to discover just how different the "new" Atari has attempted to be. Could someone have been listening?

Meet the New DOS

It may seem as if we're losing ground, what with DOS 3.0 now yielding to DOS 2.5, but in this case, a little backward movement has resulted in a great leap forward. Say hello to DOS 2.5, which offers the increased capacity of DOS 3.0 along with DOS 2.0 compatibility.

If you have a 1050 drive, DOS 2.5 will open up 1010 sectors per disk, as opposed to 707 under DOS 2.0, and you can read disks of either format from both versions of the DOS. Under DOS 2.0, tracks are blocked into 18 sectors each. Under DOS 2.5, fully 26 sectors are squeezed out of each track. Your 1050 drive can distinguish between format densities automatically at boot time.

Although DOS 2.0 ignores all sectors beyond its standard 707, it will read those sectors compatibly. More important, old format disks will read compatibility under DOS 2.5. This is where DOS 3.0, among other failings, was at its worst. Because of its incompatibility, DOS 3.0 never really caught on with 1050 owners.

Atari will ship DOS 2.5 with all new 5.25" drives. But in tangible evidence of its attitude shift toward user group support, Atari has given David Duberman (late of *Antic*, now with Atari), the go-ahead to post DOS 2.5 and related files on the CompuServe Atari SIG. Obtaining 2.5 will cost only your connect time. To that I can only say "Bravo, fellas"!

Say hello to DOS 2.5, which offers the increased capacity of DOS 3.0 along with DOS 2.0 compatibility.

When DOS 2.5 meets an Atari 130XE, however, the fireworks truly begin. One of the files present along with DOS 2.5 is a RAMdisk, which checks to see whether your drive is hooked up to a 130XE. If you are, DOS 2.5 defines the top half of RAM as "drive 8," and allows it to function as a super-fast disk drive. The RAMdisk has a directory and 499 "sectors," and you can use it along with regular disk drives without problems. The RAMdisk file copies DUP.SYS and MEM.SAV into RAM, and moves the DOS pointer so that DOS can be invoked at any time without disk access. Very handy indeed.

ScuttleBytes

I first wrote under this subhead back in 1982, and the first rumor I ever reported was that Atari planned a Model 600. So the rule is to take this section with a grain of salt. Honest, dear readers, they really did plan a Model 600 at the time . . .

The first juicy one was reported by Dave Peyton on CompuServe, who had it that Jack Tramiel might be contemplating the purchase of Delphi, the online service belonging to General Videotex Corp. Seems number-one-son Leonard Tramiel spent fully three days meeting with Delphi brass up in Cambridge, MA, an "exceptionally lengthy" stay, according to Dave, merely to set up an Atari service on the network. If such a sale were to transpire, it could mean a much-needed boost for Delphi, which has struggled to make its service competitive with the likes of the Source and CompuServe.

At this juncture I'll make a prediction: some day a truly flexible, inexpensive, and easy-to-use network for home users will appear—one that actually understands the needs and wants of its subscribers. That system will prevail in a dramatically short time. For the resource does not reside in the service, but in the users themselves. All they seek is the cheapest and best forum through which to get in touch with each other. If Jack wanted to turn his mind to that topic, he could make Delphi the pre-eminent home user's network in a matter of months.

The next juicy rumor also appeared on CompuServe and was reported by John Edwards, the gist being that Atari may already have decided to scuttle its low-end models in both the 8-bit and 16-bit categories. His sources told him that plans to market the Atari 65XE and 130ST have been "permanently shelved." Sounds pretty feasible.

We have noticed the almost negligible announced price differential be-

tween the 65 and 130 XEs ($40) and had doubted such a structure would make sound marketing sense. In the case of the 130ST, it is quite likely that the Macintosh, ST computers will require a minimum of 500K to be truly useful. Unlike Apple, Atari may not choose to release a low-power version of its new machine. In as far as it may be a decision to trim the product line to conserve precious monetary resources, we applaud the move. Damn the torpedos and full funding ahead for only the truly deserving models.

Edwards also reported, and I have subsequently confirmed, that Atari had without much explanation pulled out of Summer CES (the Consumer Electronics Show). Again one might at first thought assume this to be a cost-cutting move, as Atari's presence at such events has in the past cost upward of six figures. But it could also presage a repositioning of Atari. In the past they have sat out of Comdex in favor of CES, thereby forsaking the business show for the home show. Now they have executed an about-face, and have decided to stake Comdex and let CES pass. Could it be that the Atari is *really* more than just a games machine?

But the heart-stopping Atari rumor of the month unexpectedly came over Kobe beef and Suntory with Kay Nishi (Mr. Microsoft Japan) in Tokyo. He had heard that a good many ST contracts with the Far East were on indefinite hold and guessed that meant severe monetary troubles for Atari—troubles that could end up scuttling all their best laid plans. After I had finished involuntarily blowing a bit of my drink out my nostrils, I ventured the hope that his sources overstated the case.

Meet the 130XE

This weekend at my local dealer I logged my first flight time with a 130XE and overall was favorably impressed. The keyboard is unfortunately still far from perfect—it feels slightly rubbery, and travel is actually somewhat excessive—you can press a key, think you've pressed the key, and not have registered a character. The RESET key is disturbingly near the BREAK key and is as easy to press as any other key. I surely hope the ST sports a keyboard superior to this one.

But the RAMdisk system honestly works, and it is truly refreshing to have access to DOS at all times without lengthy disk accesses. Other programs also load neatly into the RAMdisk. Compatibility seems complete, and it is unlikely the need will arise for another software patch like the translator disk we saw when the 400/800 series gave way to the XL series (although you may find yourself using the original translator disk now and then). The machine worked flawlessly, with fine display quality, and the dealer reported only one unit D.O.A. out of a total of eight he had received over the past two weeks. His retail price: $149.95.

Listing 1.

```
10 REM CUSTOM CHARACTER SET--FIRST
15 REM ATARI PROGRAM IN QUITE A WHILE
20 REM BY JOHN J. ANDERSON
25 REM (c) 1985 CREATIVE COMPUTING
30 REM ------------------------------
35 REM THIS PROGRAM PUTS A NEW
40 REM CHARACTER SET INTO RAM
45 REM ------------------------------
50 REM UPPER CASE IS LARGER AND MORE
55 REM HANDSOME--LOWER CASE HAS TRUE
60 REM DESCENDERS AND LOOKS A WHOLE
65 REM LOT BETTER THAN ROM SET.
70 REM ------------------------------
75 REM THIS PROGRAM IS AVAILABLE FOR
80 REM DOWNLOAD ON CREATIVE COMPUTING
85 REM ONLINE--COMPUSERVE PCS-22.
90 REM ------------------------------
100 MT=PEEK(106):GT=MT-8:POKE 106,GT:GRAPHICS 0
110 CROM=PEEK(756)*256:CRAM=GT*256:POKE 756,GT:? "MOVING DEFAULT SET FROM ROM
TO RAM"
120 FOR N=0 TO 1023:POKE CRAM+N,PEEK(CROM+N):NEXT N:? :? "UPPER CASE NOW
LOADING -":? "ABCDEFGHIJKLMNOPQRSTUVWXYZ"
130 FOR N=264 TO 471:READ A:POKE CRAM+N,A:NEXT N:? :? "lower case now loading
-":? "abcdefghijklmnopqrstuvwxyz"
140 FOR N=776 TO 983:READ A:POKE CRAM+N,A:NEXT N
150 ? :? "--- HAPPY CREATIVE ATARI COMPUTING ---"
1000 DATA
60,102,102,126,102,102,102,0,124,102,102,124,102,102,124,0,60,102,96,96,96,102
,60,0
1010 DATA
124,102,102,102,102,102,124,0,126,96,96,124,96,96,126,0,126,96,96,124,96,96,96
,0
1020 DATA
60,102,96,110,102,102,60,0,102,102,102,126,102,102,102,0,60,24,24,24,24,24,60,
0
1030 DATA
6,6,6,6,6,102,60,0,102,108,120,120,108,102,102,0,96,96,96,96,96,96,126,0
1040 DATA
99,119,127,107,99,99,99,0,102,118,126,126,110,102,102,0,60,102,102,102,102,102
,60,0
1050 DATA
124,102,102,124,96,96,96,0,60,102,102,102,102,102,60,6,124,102,102,124,108,102
,102,0
1060 DATA
60,102,96,60,6,102,60,0,126,24,24,24,24,24,24,0,102,102,102,102,102,102,60,0
1070 DATA
102,102,102,102,102,60,24,0,99,99,99,107,127,119,99,0,102,102,60,24,60,102,102
,0
1080 DATA 102,102,60,24,24,24,24,0,126,6,12,24,48,96,126,0
2000 DATA
0,62,102,102,102,62,0,0,96,124,102,102,102,124,0,0,0,60,96,96,96,60,0,0
2010 DATA
6,62,102,102,102,62,0,0,0,60,102,126,96,60,0,0,28,48,124,48,48,48,0,0
2020 DATA
0,62,102,102,102,62,6,60,96,96,124,102,102,102,0,0,24,0,56,24,24,60,0,0
2030 DATA
12,0,12,12,12,12,12,120,96,96,108,120,108,102,0,0,56,24,24,24,24,60,0,0
2040 DATA
0,102,127,127,107,99,0,0,0,124,102,102,102,102,0,0,0,60,102,102,102,60,0,0
2050 DATA
0,124,102,102,102,124,96,96,0,62,102,102,102,62,6,6,0,124,102,96,96,96,0,0
2060 DATA 0,62,96,60,6,124,0,0,24,126,24,24,24,14,0,0,0,102,102,102,102,62,0,0
2070 DATA
0,102,102,102,60,24,0,0,0,99,107,127,62,54,0,0,0,102,60,24,60,102,0,0
2080 DATA 0,102,102,102,62,12,120,0,0,126,12,24,48,126,0,0
```

Fancy Font

Let's face it, Atarians. The default character set provided on the Atari is not the most beautiful thing in the world. Sometimes I get tired of it, and then I load a custom set. Listing 1 provides you with one of my favorites. It is fancy enough to seem special, while maintaining high legibility. Give it a try!

Atari Corporate BBS

In addition to their participation in CompuServe and possible participation in Delphi, Atari now maintains its own bulletin board on one of the few Model 1450 XLDs ever built. There are now four lines available, so it is much easier to get through than it had been initially. The number is (408) 745-5308, and the BBS is up 24 hours a day. ■

COMMODORE'S PORT

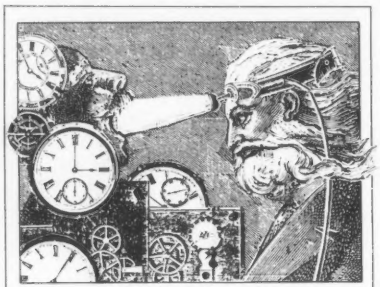
An introduction to ANDs, ORs, PEEKs, and POKEs/**Alfred J. Bruey**

Even if you don't write Commodore programs, you have probably noticed the words AND and OR as you were looking through a program listing or typing in a program from this magazine. You are almost sure to encounter a line of Basic coding that contains an AND or OR if you are working with a program that uses the sound capability of the C64. For example, you might have seen an instruction like:

100 POKE X, PEEK(X) AND 15

If location X is the location that controls the attack/decay parameters for voice 1, this instruction will change the attack value to a 0 and leave the decay value unchanged from what it was when the POKE instruction was executed.

If you understand what you have just read, you probably don't need to read the rest of this column. If you *don't*, stick with me, and you'll gain at least an elementary understanding of ANDs, ORs, PEEKs, and POKEs. Let's start at the beginning.



The PEEK instruction is used to find the value in a specific 8-bit memory location (byte) of memory.

Binary Numbers

ANDs and ORs work at the *bit* level. A bit, which is the abbreviation for binary digit, can have one of two values, a 0 or a 1. The decimal digits with which you are most familar can have the values 0 through 9. A decimal number larger than 9 can be created by placing decimal digits side-by-side. In this way we create the number 7849 by placing the digits 7, 8, 4, and 9 side-by-side. The decimal number system is a *place value* system, that is

$7849 = 7*1000 + 8*100 + 4*10 + 9$

$7849 = 7*10^3 + 8*10^2 + 4*10^1 + 9*10^0$

There is a direct analogy between this example and the interpretation of a binary number such as 10110011 or 01011101. These binary numbers can be converted to an equivalent decimal value just as we did above, except that the place value system here is represented by powers of 2 instead of 10 as it was in the preceding example. So

$10110011 = 1*2^7 + 0*2^6 + 1*2^5 + 1*2^4 + 0*2^3 + 0*2^2 + 1*2^1 + 1*2^0$

$10110011 = 128 + 0 + 32 + 16 + 0 + 0 + 2 + 1 = 179$

where the original binary number is in base 2 and 179 in a base 10 number. I won't bother stating the base that I'm using in the remainder of this article since it will be obvious.

Why Eight Bits Long?

It is no coincidence that both of the examples of binary numbers that I gave above are eight bits long. A string of eight bits in a row is called a *byte*. Although 16-bit microcomputers are becoming more common, a large number still have an 8-bit (1 byte) capacity for each memory location. This is what we mean when we say that the Commodore 64, for example, is an 8-bit computer. The first bit in the string of 8 is usually called bit 7, the second bit 6, and so on, with the final bit being called bit 0. You can see that the name of the bit represents the power of two associated with that position.

The largest number that can be held in 1 byte is, obviously, 11111111. You should be able to use the conversion method shown above to show that this is the binary representation of the decimal number 255. That is why you get an error message if you try to POKE a value like 800 into a C64 memory location. To see that this is so, try entering the line:

POKE 49152,800

If you do this on the C64, you should get the message:

? ILLEGAL QUANTITY ERROR

Remember—any number POKEd into a memory location must be between 0 and 255.

Back to the Subject

Now that we know what binary numbers look like, let's see how we can operate on them with ORs and ANDs. First, let's look at the OR statement. How do we find the result of the operation

11010001 OR 10100010?

It's simple. The result of ORing two binary numbers together is a number that has a 1 in any position where either or both of the two numbers has a 1 and has a 0 in any position where both of the original numbers have 0's. For our example:

```
  11010001
OR 10100010
  11110011
```

But why would anyone want to OR two numbers together? Let's look at an example. Assume we want to make the low order 4 bits (bits 3, 2, 1, and 0) of location X all 1's and leave the high order 4 bits (bits 7, 6, 5, and 4) as they were. We can do this by ORing our unknown number in location X with the binary number 00001111.

For example, assume that location X contains the value 10100010. Then:

```
  10100010
OR 00001111
  10101111
```

As predicted, we made the low order 4 bits all 1's and didn't change the high order 4 bits. If you are still a little unsure of this process, try it on a few more examples until you begin to feel comfortable with the OR operator.

Now, on to the AND operator. The result of ANDing two numbers together is a third number which has a 1 in any position where both of the original numbers had 1's and a 0 otherwise. For example:

```
  10101010
AND 00110111
  00100010
```

The AND is often used to turn off a bit (change it to 0) or group of bits. For example, if we want to turn off bits 2 and 3 of a number without changing the other 6 bits, we can AND the number with 11110011. For example:

```
  10101101
AND 11110011
  10100001
```

That's all there is to the AND Operator. We'll get back to some more examples later.

Using the AND and OR With Decimal Numbers

If you start looking through listings of Basic programs for uses of the AND and OR operators, you won't find anything like:

100 X = Y OR 11110000

We would like this statement to create a number X which leaves all 1's in bits 7, 6, 5, and 4 and leaves bits 0 to 3 unchanged. But it won't. Why not? Because the Basic language assumes the number 11110000 to be the decimal number 11,110,000. Therefore we will get our old friend, the ILLEGAL QUANTITY error.

To get the statement above to operate properly, we must convert the binary number 11110000 to decimal. If you remember what you learned above, you should be able to convert this binary number to 240. Thus you must write the statement above as:

100 X = Y OR 240

For more practice, let's return to our earlier example and write the numbers side-by-side in both their binary and decimal forms:

```
  11010001 =   209  |    11010001 =   209
OR 10100010 = OR 162  |  AND 10100010 = AND 162
  11110011 =   243  |    10000000 =   128
```

Notice that you can make a rough check on any manual calculations that you do with ANDs and ORs, since the result of an OR will always be at least as large as the larger of the two numbers and the result of an AND will never be any larger than the smaller of the two operands.

From now on, I will be using the decimal values of the operands. If you are not quite sure what is happening, convert the decimal values to their binary values and look at what happens bit-by-bit.

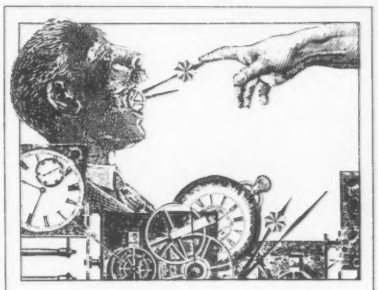
The POKE and PEEK Statements

That is about all you need to know about the Basic AND and OR operators. But now that I have you here, I might as well show you how they can be used in a Basic program.

First let's spend a minute or two on the POKE and PEEK statements. These two statements are Basic statements, but they act more like machine language operations since they operate directly on the contents of RAM or ROM. Let's look at the PEEK statement first.

You won't normally use an AND or an OR in a PEEK statement, but the OR and AND become useful when combined with a PEEK statement that is used as part of a POKE statement. Confused? You soon won't be. Look back at the very first paragraph of this column and you will see the PEEK command being used with AND as an operand in a POKE statement.

The PEEK instruction is used to find the value in a specific 8-bit memory location (byte) of memory. As you have learned, the value that you find will always range from 0 to 255. Some locations cannot be PEEKed at. Which locations these are depend on the computer. The early versions of the Commodore computers, for example, did not allow you to PEEK at any of the machine locations that held the Basic interpreter. This kept the details of their interpreter secret for almost an hour, the time that it took skilled users to write a machine language program to print out the contents of the ROMs. In the Commodore 64, you cannot PEEK for values in the music locations—location 54272, for example—even though you can put a number into this location with a POKE statement.



The sole purpose of the POKE instruction is to make a change in some memory location in RAM.

What you should try to do now is to try a few PEEK instructions. The format of the PEEK is simple. To PEEK at what is in location X and print out the value, enter:

```
X=17:PRINT PEEK(X)
```

and press RETURN. You should see a value from 0 to 255 on the screen unless you have asked for the contents of some impossible location like –220 or 72558, in which case you will see an error message. Guess which one. You're right—ILLEGAL QUANTITY.

Go ahead and try the PEEK with a variety of values for X. You can't change anything with the PEEK since you are just looking to see what is there.

Such is not the case with the POKE instruction. The sole purpose of the POKE instruction is to make a change in some memory location in RAM. It is quite possible to change a memory location in such a way that the computer will fail to operate correctly. If this happens, you might have to turn the computer off and then back on again, but this is the worst that can happen.

The POKE instruction has one more parameter to specify than the PEEK. For the POKE, you must specify both the location into which you want to insert a value and the value itself. The format is—POKE X,Y where X is the location address and Y is the value you want to place in location X. Y must, of course, be a value from 0 to 255. You can POKE values into a location in a Basic program or you can use a direct statement such as:

POKE 53281,12

which puts a 12 into the background color location on the C64, or the statement:

POKE 59468,14

which changes the character set from graphics to lowercase on the original Commodore PET/CBM models (POKE 59468,12 changes back to graphics from lowercase).

In your experimenting, you will probably want to add a PRINT PEEK statement to see that the POKE worked. For example, on the C64 or VIC 20, if you enter

POKE 5000,10

and then

PRINT PEEK(5000)

you should see that the POKE put a 10 in location 5000.

You should also try this short program:

```
10 FOR I = 0 TO 500
20 POKE 5000, I
30 PRINT PEEK(5000)
40 NEXT I
```

What do you think will happen? The program will print out the values from 0 to 255 and then stop abruptly with an error message when you try to force a value of 256 into the 8-bit location.

A Final Example

I said earlier that we would sometimes find it useful to use both the PEEK and POKE in the same instruction. There are occasions when it is useful to be able to change, say, the lower four bits of location X to all 1's while leaving the high four bits unchanged. We have already seen that we can do this by ORing the value in location X with the binary number 00001111, which is decimal 15. We can perform this change with the one instruction:

POKE X, PEEK(X) OR 15

To see how this works with a specific example, RUN the following program:

```
10 POKE 5000,128
20 PRINT PEEK(5000)
30 POKE 5000, PEEK(5000) OR 15
40 PRINT PEEK(5000)
```

The PRINT statement in line 20 should return a value of 128 and the PRINT in line 40 should give you a value of 143 since 143 = 128 AND 15. If this isn't obvious to you, you should write out 128 and 15 in binary and calculate the final value for yourself.

Similarly, you should be able to figure out what happens when you replace the 128 in line 10 with 133 and replace line 30 with:

30 POKE 5000, PEEK(5000) AND 15

Notice that I changed the OR to AND. Try this and see what happens. (You should get a value of 5. Why?)

Since we are just changing a noncritical location in RAM with this program, we can't hurt anything. But, in general, you should always SAVE a program that contains a POKE before you try to RUN it the first time. Otherwise an error in some POKE address or value might force you to type in the program all over again.

Conclusion

By now you should have a better understanding of:

- How the AND and OR operators work.
- How the PEEK and POKE statements work.
- How ANDs and ORs can be used in PEEKs and POKEs.

With some practice, you should gain an understanding of these concepts and in no time at all be using them in all your programs. ■

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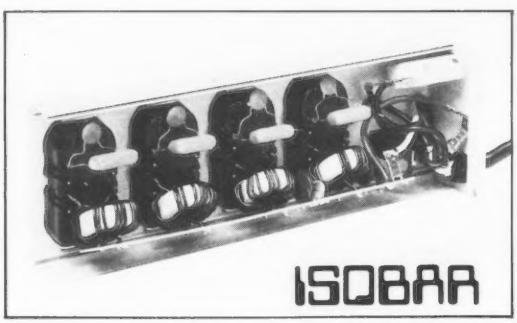

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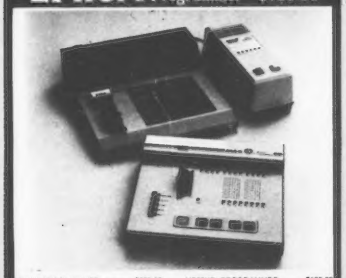

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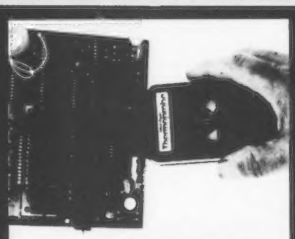

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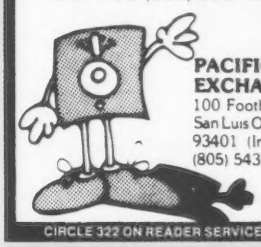

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As compiled from National Retail Store Sales Report for week ending Jan. 5, 1985.

INTRODUCING SPINWRITER E·L·F!

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See your dealer for a Spinwriter elf demonstration. You'll find the elf can print an average letter in less than a minute. You'll find it comes standard with a sheet guide.

Makes popular software look even better.

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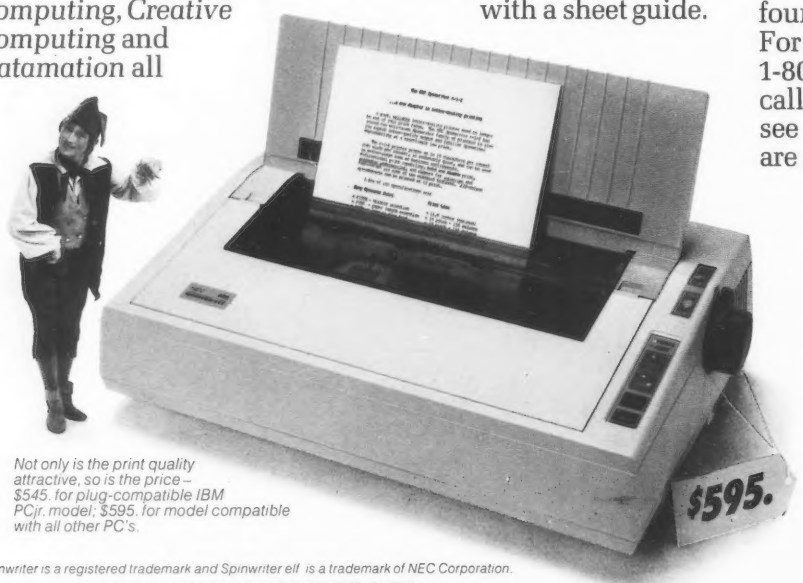
So see your dealer about the Spinwriter elf today. And you'll know you've found the right printer. For more information call 1-800-343-4418. (In MA call 617-264-8635). And see why so many PC users are saying, "NEC and me."



Not only is the print quality attractive, so is the price – $545. for plug-compatible IBM PCjr. model; $595. for model compatible with all other PC's.

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